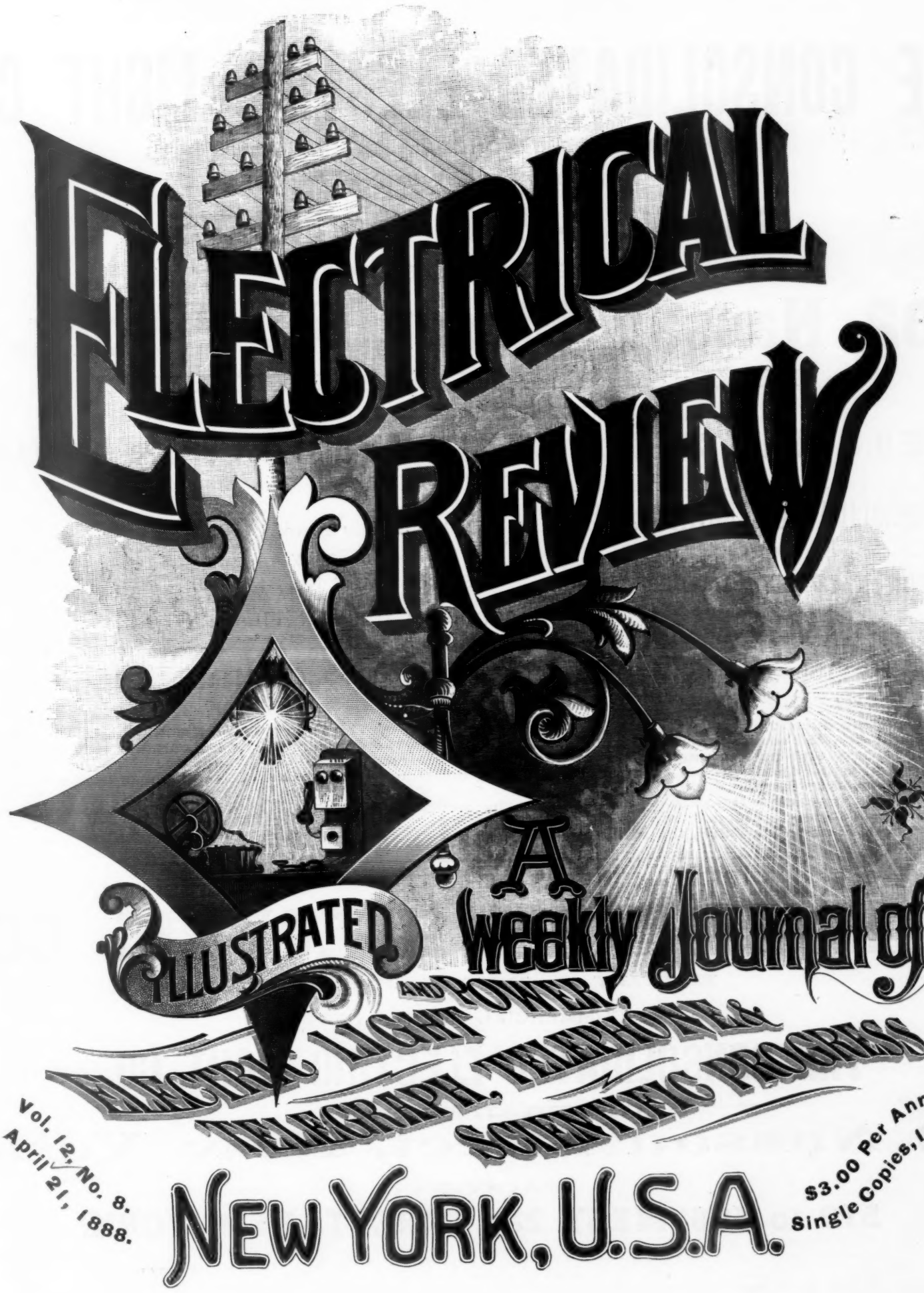
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THE CONSOLIDATED ELECTRIC LIGHT CO.

GEORGE WESTINGHOUSE, Jr., President,

OWNERS OF THE

SAWYER-MAN PATENTS,

GENERAL OFFICE:

32 Nassau Street, New York.

(EXTRACT.)

IN THE U. S. CIRCUIT COURT FOR THE WESTERN DISTRICT OF PENNSYLVANIA.

THE CONSOLIDATED ELECTRIC LIGHT CO.,
VS.
THE McKEESPORT LIGHT CO.
[EDISON COMPANY.]

No. 5, May Term, 1888,
In Equity,
Suit on Patent No. 317,676.
FIBROUS CARBON FILAMENT.

ON DEMURRER TO BILL OF COMPLAINT.

ACHESON, J.

The precise question here presented was raised in the case of The Consolidated Electric Light Co. v. Edison Electric Light Co., 25 Fed. Rep. 719, and was decided adversely to the defendant. I have carefully read the opinion of Judge Wallace, and perceive no reason for doubting the correctness of his conclusion. How can it be said that the patent was issued without authority of law, and, therefore, is void, when, in fact, it was issued to the very person designated by Section 4,895? * * * * * * * * * * *

While this view saves the patent and subserves the justice of this case, it is neither counter to sound public policy nor tends to any evil consequences, so far as I can see.

And now, March 17th, 1888, the demurrer is overruled. * * * * * * * * * * *

SAWYER-MAN ELECTRIC CO.

HENRY C. DAVIS, President,

COMMERCIAL AGENTS OF

THE CONSOLIDATED ELECTRIC LIGHT CO.,

GENERAL OFFICE:

32 Nassau Street, New York.

FACTORY:

510 to 536 WEST 23d STREET, NEW YORK.

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The Future of the Phonograph.

HUMOROUSLY PRESENTED BY COL. J. ARMOY KNOX.

The phonograph will soon be "in our midst." The inventor says that it is perfected and is being manufactured for sale. When we get one we shall merely have to talk at it, and it will record every articulate sound; then at any time in the future we shall have only to turn the handle of the thing and it will reproduce the words, the tone and the accent exactly as received from us.

Possibly the instrument may be developed until vest-pocket phonographs are made, and we can all carry them around with us and collect the flashes of folly and whisperings of wisdom expressed to us by our friends and acquaintances. There will be advantages and disadvantages in this. The autograph pest will throw away his album and buy a phonograph. He will come around and present the muzzle of the instrument to you and request you to load it up with a few remarks to be preserved, so that they may be fired off at future generations. The opera singer will be asked to warble a carol into its lungs, and the statesman to fill its throttle with his views on the political problems of the hour, and these will be duplicated, as a woodcut or steel engraving is, and amateur phonographers will make private collections of all sorts of sounds, from the hoarse toot of a foghorn to the soft sibilant swish of an unripe picnic kiss, and will reproduce them at will. And Mrs. Jones will set the trigger of her phono when Jones comes home at 2 A. M., and, pursuing him around the room, will capture every lie he tells and every hiccough he hics, and even the noise he makes falling over his feet, and at the breakfast table next morning she will turn it loose on him and paralyze him with his own abbreviated words and tangled language of the night before, and he will be much embarrassed thereat.

Again there is the reporter; he will use it, and when you tell him that you are "not a candidate, and would not under any circumstances accept the nomination if tendered," he will file away your remarks until you deny that you ever uttered them, and then, from his inside pocket, he will draw forth his phonograph and you will wish you had bought a time lock for your mouth.

Pity, isn't it, that the phonograph was not invented a few thousand years ago, because if it had, down through the corridors of time might have reverberated the echoes of the great events of the past, and we of to-day could have taken our phonos out on the back stoop in the long summer evenings and listened to the roar of the lions in Daniel's den, the sound of Nero's fiddle and the clatter of the Roman Empire as she fell.

If this wonderful instrument is possible, why may it not be possible to invent a machine that will take our unvoiced thoughts as we think them, and record them in some way so that they may be afterward transferred to paper? What vagaries of thought the thinkograph would reveal—what delirium tremens of imaginings would it disclose! In cold type they would astonish even the thinker.

Have you not sometimes got into a train of thought that you could not control and that would get off the track and go away on an open switch, and stop at crossings, and change its course at junctions, and sometimes come back to the starting point or go out into space and end nowhere? I started on one of these trains last night. I could not sleep. Whether my wakefulness was caused by conscience or cheese matters not. My first thought is that I want to sleep but cannot, and I wonder if there is any bromide of potassium in the house, and thinking of bromide brings me naturally to drug stores, and I think of a little shop on the Rue de something in Paris, where once I had so much fun in making a comical little druggist understand my Anglo-French, and that carries me into the Eden Theater that is just around the corner from the little druggist's little druggery. That suggested other theaters, and in a moment I am across the channel in a Liverpool theater, where I see a cadaverous man on the stage in a garret scene addressing a girl and saying, "No, no, me cheild, I cannot—I cannot eat;" and I hear a voice from the gallery saying, "Well then av I wus a mutten-chop I declare to me God I wudn't loike to be sittin' for ninst ye this minute." The mutton suggests sheep, and carries me at once to a sheep ranch on the plains of Texas, and my thoughts wander through more or less painful experiences that I had in raising sheep, and I remember these lines that I once composed all by myself, without the use of a net and unassisted by any apparatus or concealed confederate:

> How doth the little shepherd dog
> Delight to bark and bite,
> And count those sheep the livelong day
> That wolves eat up at night.

And that switches my thoughts to my first night in the woods, and I see myself, a novice in woodcraft and very ignorant of Western life, the guest of a number of sheepmen with whom I have been out in pursuit of deer. We are camped on the banks of a creek in a dense wood. I am lying on the hard ground with nothing but a folded ear for a pillow, and nothing for a covering but the mantle of night and an old saddle blanket. The campfire has burned down to a mere spark, and I am just about to go to sleep when, from every direction close around our camp, comes the most terrific and dismal yells and howls I ever heard. "Hear that?" shouts one of my companions, as he rushes past me in the dark. "If you don't want a wolf's hide for a shroud, skin up a tree." I skin up the first tree I run my nose against and sit on a unnecessarily hard and jagged limb listening to the wolves yawping and snarling until day dawns, when I discover my companions sleeping on the ground not ten yards away. It is merely a practical joke played on me with a view to breaking me in. The wolves are coyotes, cowardly wretches who prey on nothing more able to defend itself than a sheep.

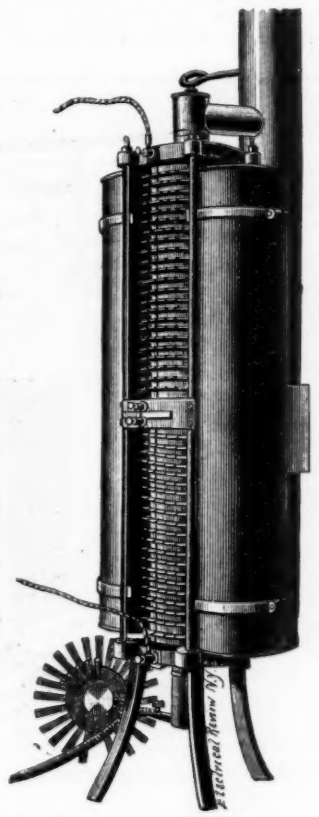
And so from the cobwebbed pigeon holes of memory come, one after another, remembrances of things that were, and my thoughts wander on from incident to incident bridging continents, circling the globe, and spanning great lapses of time until I go to sleep.

"Yes, when we get the thinkograph, it will be a great boon to writers. We shall not have to twice repeat our remarks to a stenographic girl with ink on her thumb, and who uses a pencil that snaps in the middle of a sentence—a girl who spells physic with an "f," and who, when you say "a conscientious buyer," brings it out on the typewritten page as "a concentrated liar."

Underground Wires in Brooklyn.

Prof. Plympton, President of the Underground Wire Commission of Brooklyn, has handed to Mayor Chapin a letter, of which the following is a copy:

I am instructed by the Board of Commissioners of Electric Subways for the City of Brooklyn to ask that you will cause to be introduced into the bill now pending in the Legislature which authorizes the issue of bonds for the expense of certain public improvements in the city, the placing of the telegraph wires of the Municipal Departments in the underground conduits already finished or to be finished during this year, as one of the objects for which the money so raised, may, in the discretion of the Mayor, be expended.



RAUB'S THERMO-ELECTRIC BATTERY.

The reason for this request is that the work of this Board is stopped short of the removal of the poles from the streets, even after all private wires have been taken down, by the continuance of the city wires, over which this Board has no jurisdiction until the necessary appropriation has been made for their removal.

It is not contemplated that a large sum shall be expended under the provisions hereby proposed, but only that along the lines of completed conduits, where the removal of the city wires would, at small cost, permit the removal of the poles, this cost should be met in the manner suggested. Appropriations for the purpose have hitherto been refused, and even if the recommendations of the Board and the requests of the city departments should be more successful this year, there would still be another year's delay before the money would be available.

The Board would be perfectly satisfied to have the amount and locality of every expenditure for this object left to the decision of the Mayor, upon presentation of the facts in each case.

—— Among the recent purchases is reported that of the property and rights of the Sun Company, of Woburn, Mass., by the Fort Wayne Jenney Company, of Indiana.

Of the Conductibility of a Vacuum.

M. Foeppl, in *Annales de Wiedemann*, gives the results of some experiments apropos of this vexed question. M. Edlund, in maintaining his theory, claims to have recognized phenomena of a luminous character, even when the vacuum has become so perfect as to prevent a visible discharge between the electrodes.

M. Foeppl has studied the currents of a secondary closed circuit, actuated by an induction coil. This first was formed on a glass tube 7 millimetres outer, and 4.2 millimetres interior diameter, and was composed of two layers of 18 turns, having an outer diameter of 67 millimetres. The electrodes of this glass coil were connected to the two ends of a second coil, also on glass, so arranged as to form a galvanometer, within which was placed a circular mirror magnet, suspended by a fibre of cocoon silk.

The primary coil was 24 centimetres in length, 7.1 centimetres inner, and 15.3 centimetres outer diameter, and was composed of 12 layers of 72 turns of copper wire 22 centimetres diameter, without the insulation. With this apparatus, and a current of 22.5 amperes, M. Foeppl could not discern the least movement of the needle, either on closing or opening the circuit.

Neither could he discover the least phosphorescent light in the glass coil, with large range of rarefaction.

The specific resistance of a vacuum, as shown by mathematical calculation, is at the least 48,000 times that of mercury; or about 3,000,000 times that of pure copper.

E. Raub's New Thermo-Electric Battery.

As will be seen from the accompanying figure, the battery consists of two main portions: 1, the annular elements and the heating channel which they form; and 2, the refrigerator, which is applied separately. The circle shown in the figure behind the tripod represents a single element; the positive electrode is formed by a ring of an alloy cast around a copper heating ring, thus effecting a very durable and intimate metallic connection. Externally it is enclosed in a second ring of copper, with refrigerating projections arranged radially. The negative metal is soldered to the heating ring in thin plates and in such a manner that during working, local currents at the points of contact are entirely avoided. After the elements have been built up, the negative metal of each is soldered to the refrigerating projections of the following element.

A number of similar thermo-elements, of any desired size, are insulated from each other by means of a fire-proof material and pressed together between two cast iron plates in such a manner that the several rings are superimposed concentrically, forming in this manner a firm, safe hollow cylinder which serves as the heating chamber. The heating is effected by means of any convenient source. For smaller apparatus like that shown in the figure a ring-shaped Bunsen gas burner is sufficient. For larger batteries a coal or coke fire is required. The flame of the Bunsen burner, screwed on to the lower end of the heating cylinder comes in intimate contact with the heating rings of all the elements, and takes up its supply of

oxygen within the conical flame. The heat is distributed equally to the elements by means of a slender cone fixed to the cover of the heating chamber and projecting into it. It then passes through a transverse channel into a wide stove pipe closed below and screwed into the supporting tripod and connected with a chimney having a good draught. The hot air ascending in the chimney draws fresh air into air pipes fixed below the point where the heating chamber vents into the main pipe so that the external points of contact of the annular elements are kept cool by the draught. A valve is introduced for the regulation of the latter.

Great economy in working is effected by the application of annular thermo-elements in combination with this forcible introduction of air, which admits of the greatest possible utilization of the heat and the production of the greatest possible differences of temperature. Collateral advantages are rapidity and ease in starting work and a minimum requirement of space, since batteries to be heated by gas may be mounted upon a bracket. As valuable features must be mentioned the durability and firmness of the separate elements, as also the possibility of removing damaged rings either for repairs or for the substitution of new ones which may be procured singly from the makers.

The three smallest models to be heated with gas and suitable for the electrolytic production of metals, for galvanoplastic, etc., consume hourly 300, 500 and 900 litres of gas (or about 11, 18 and 30 cubic feet), having strengths of current of 10, 20 and 40 amperes with an electromotive force of 3 volts. For an hourly consumption of 1 cubic metre these batteries give a useful effect of 80 volt-amperes, whilst those of former constructions yielded at most 27.—*London Electrical Review.*

Electric Motors in Mills.

An installation was made at the Tremont & Suffolk Mills at Lowell, Mass., about four months ago, which has excited considerable interest among mill men in that section of the country.

The difficulty to be overcome was the transporting and handling of cotton bales and heavy cases of cotton goods by the slow and expensive method of man power.

As the buildings were located, all freight was received and delivered from one place. This necessitated some method of transporting the freight, such as cotton bales, etc., from this spot, and also the gathering of the manufactured goods from over the mill, and the storing of the same at the freight house.

Figures were asked for from one or two of the prominent motor companies, but nothing special was done until the Thomson-Houston Company took hold of the matter.

Plans were at once made, and after a few preliminary changes and suggestions, the work was commenced upon. In a very few weeks a motor was designed and placed on the specially designed car of the superintendent. For the last three or four months this motor has been running, giving perfect satisfaction.

The conditions are about as follows:

Total distance, 800 feet, running from one building across a bridge into another building, and the entire length of this one. This line was not, throughout, a level one, since the passage from one building to another necessitated a grade of as high as 3 to 3½ per cent. The system to be used was the single wire overhead method, the rails to answer for the return. The duty of the motor was to transport about four tons.

All these conditions were met and successfully complied with. From the day of its starting no trouble whatever has been experienced, and the mill owners are perfectly satisfied with its operation, and we believe that they contemplate a considerable extension to this line, as they find that it is one of the most convenient mechanical arrangements which they have about their whole mill. The gauge of this track is the standard size, 4 feet, 8½ inches, but, in the language of a very prominent mill engineer who got on to the car and took several rides and examined its operation very closely, this system of collecting goods and carrying them to local points is destined to a very general adoption.

If one is at all familiar with these large mills, and the great floors several hundred feet long by hundreds of feet wide, they will very readily see that a narrow gauge track, running the entire length of the room upon a floor can be laid, and a small platform motor used to gather the cloth as it is taken from the machines.

The success of this has brought about a number of very important arrangements, and we understand that the company, realizing its great importance, are preparing for a very extensive line of work in this direction.

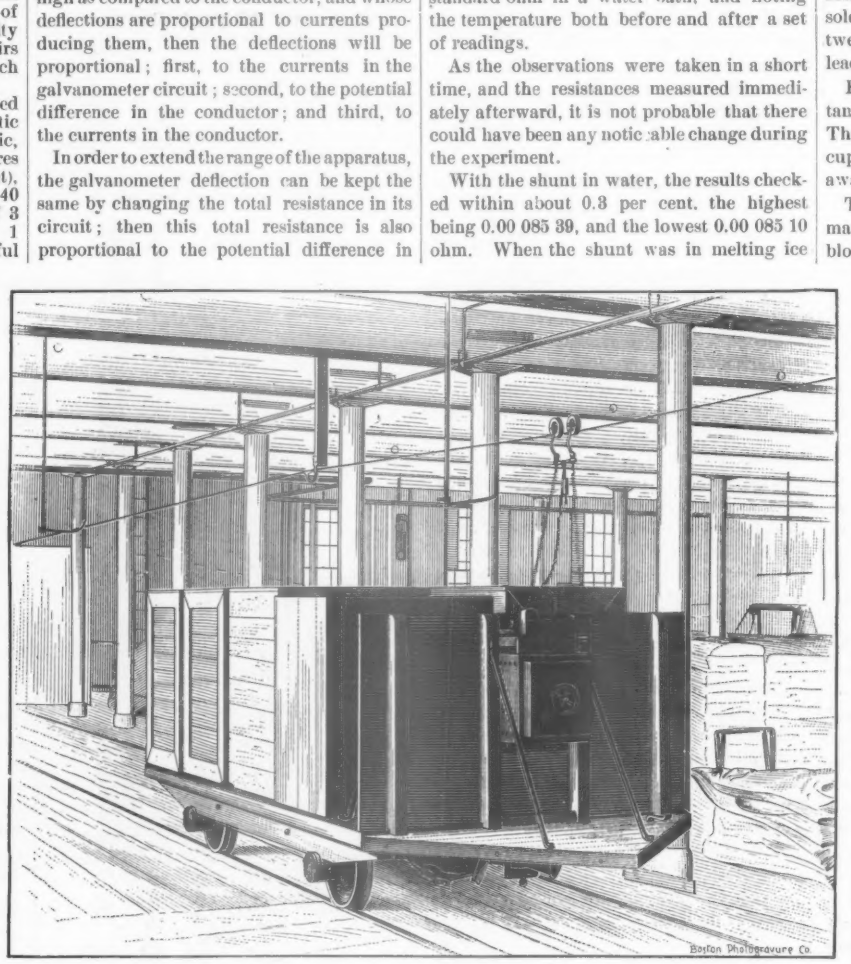


FIG. 1.—SHOWING APPLICATION OF ELECTRIC MOTOR IN TREMONT AND SUFFOLK MILLS.

A Study of Certain Errors in the Constant Shunt Method.

By WILLIAM L. PUFFER, S. B., of Rogers' Laboratory of Physics, read at a meeting of the American Academy of Arts and Sciences, January 11, 1888.

A very neat and valuable application of Ohm's Law is that usually called the shunt method for the determination of current. The method is described in the Munich, Vienna, and Philadelphia reports on dynamo tests.

The principle is this: If a conductor of constant unknown resistance be placed in a circuit, and currents of different strength passed through it, there will be a difference of potential at the terminals of the conductor proportional to the currents flowing; and if this conductor be placed as a shunt upon a reflecting galvanometer whose resistance is high as compared to the conductor, and whose deflections are proportional to currents producing them, then the deflections will be proportional; first, to the currents in the galvanometer circuit; second, to the potential difference in the conductor; and third, to the currents in the conductor.

In order to extend the range of the apparatus, the galvanometer deflection can be kept the same by changing the total resistance in its circuit; then this total resistance is also proportional to the potential difference in the conductor. In order to save time, the galvanometer deflection may be nearly the same and the product of the deflection and corresponding total resistance taken; these products will then be a measure of the corresponding currents in the conductor. If a known current be passed through this conductor or shunt, and the galvanometer deflection and total resistance of the galvanometer circuit multiplied, and the product divided by the known current expressed in amperes, we get the constant of the apparatus for amperes. To find value in amperes of an unknown current, we have only to note the deflection and total resistance in galvanometer circuit, multiply them, and divide by the constant. Or we could divide the known current by the product of resistance and deflection, and get a constant by which to multiply the resistance and deflection obtained with the unknown currents.

The range of the method is very great, and is, perhaps limited only by the difficulty of making a suitable shunt of such a cross section as to be free from injurious heating by the currents used.

Wishing to employ this method in the Rogers' Laboratory of Physics in a slightly different way, requiring that the shunt resistance be known, I made some experiments to determine the resistance of a German silver rod 3 feet long and 0.6 inch in diameter, with the intention of using it as a constant shunt of *known* resistance for currents from about 1 to 60 amperes. An inch from each end a small wire of German silver was silver-soldered in a hole drilled nearly through the rod, and the lead wires running to a low resistance galvanometer were connected by screw-clamps. On the ends of the shunt were soldered brass screw connections for insertion of the main wires.

A standard ohm was placed in circuit with the shunt by means of mercury cups and the resistance of the shunt found by comparison of the potential at its terminals with that at the terminals of the ohm, using a Hartman dead-beat galvanometer and resistance box as usual with the shunt method.

The results were very unsatisfactory, although care had been taken to prevent, as far as possible, any error due to change in temperature, by placing both the shunt and the standard ohm in a water bath, and noting the temperature both before and after a set of readings.

As the observations were taken in a short time, and the resistances measured immediately afterward, it is not probable that there could have been any noticeable change during the experiment.

With the shunt in water, the results checked within about 0.3 per cent. the highest being 0.00 085 39, and the lowest 0.00 085 10 ohm. When the shunt was in melting ice the results were more variable, and in air very bad. A careful test of the wires and connection showed that when there was no battery in circuit, there was a variable electromotive force in both the galvanometer circuit, and in the shunt itself, sufficiently great to account for the errors in previous work.

The error in the galvanomer circuit was avoided by greater care in manipulation and the use of a mercury commutator; but the shunt proved so troublesome that a study of the nature of the small, disturbing electromotive force observed seemed desirable.

As this error, which I attributed to thermal action, was entirely negligible in the standard ohm because of the comparatively high difference of potential produced by the calibrating current, I thought that a German silver shunt, capable of carrying 5 to 10 amperes, having a resistance of from 0.1 to 0.2 ohm, might be compared with the ohm, and then with the shunt, without any appreciable error from heating or thermal action.

The following is a brief description of the shunts made, and the arrangements for taking observations and avoiding errors:—

The large German silver shunt has already been described. The standard German silver shunt was made of a 50-foot length of wire of ¼ inch diameter, drawn to order and of the quality known as "18 per cent." A short length of No. 14 German silver wire was looped around this shunt near each end and silver-soldered to it, using borax as a flux, and similarly a set of copper wires as well, thus giving me virtually two shunts of the same resistance and material, differing only in the metal wires used for the potential leads. The shunt wire was doubled and bent back and forth through porcelain insulators fastened to a piece of board. Also a copper shunt was made of two pieces of No. 00 wire, each eleven feet long; these were connected by being soft-soldered into a brass block, using resin as a flux, and then coiled in the same directions, to avoid magnetic disturbance, and suspended from ebonite supports in a stone jar. At three places on this shunt—near each end and in the middle near the brass block—were soldered a set of four wires. Each set of four contained a German silver and a copper wire, silver-soldered with borax, and a similar pair soft-soldered with resin. This was equivalent to twelve simple copper shunts, with different leading wires and solders.

Each of these three shunts was placed in a tank of water provided with a thermometer. The potential wires were carried to mercury cups and commutators on a table thirty feet away, where the resistance boxes were placed.

The galvanometer was a double coil Hartmann, with bell magnet and copper damping-block; the deflections were read by a telescope and scale at a distance of 3.68 metres.

The galvanometer wires were soldered to amalgamated brass rods held in a piece of ebonite provided with a long handle, used in changing the connection from one set of wires to another.

In order to avoid temperature correction, the shunts were placed in water and carefully watched until it was evident there was no perceptible heating of the water or wires by the current. A loop of the galvanometer leads was always connected to a Wheatstone Bridge used to measure the resistance in circuit. There was never any change large enough to cause any trouble, as the measurements were all taken in a short time, and the rise of temperature was very slow.

The deflections were always brought to about 10 double centimeters each side of the middle of the scale, and were written 1,000, calling the tenth of smallest division unity. Within the limits of the scale the proportionality of the deflections was nearly perfect, and quite so within the limits of working. The error due to change in length of the suspending fibre was studied, and found to be negligible only when the precaution was taken to compare a mark on the mirror with a mark on the metal frame of the instrument, and adjust the height of the mirror to 0.1 or 0.2 millimetre. The torsion of the fibre was negligible in the range of deflections used.

The galvanometer and its connecting wires had a resistance of 4.7 ohms, and was used as a voltmeter for measuring the thermal electro-motive forces with an accuracy of about 5 per cent. The factor 0.00 000 040 was used to multiply the deflections by in order to obtain the thermal action in volts, when no resistance other than the galvanometer and connecting wires was in circuit.

It was assumed that these shunts would be calibrated with a current of 1 ampere, and that an accuracy of 1 part in 1,000 was desirable. The table gives the resistance of the shunts, and also the volts corresponding to an error of 0.1 per cent. of the difference of potential caused by a calibrating current of 1 ampere. These small electro-motive forces are represented by 2 units of deflection of the voltmeter in the case of the copper and the large German silver shunts, and 2,000 with the standard shunt.

	Resistance in ohms.	0.1 per cent. P. D., due to an ampere.
Large German silver shunt	0.00 085	0.00 000 085
Standard German silver shunt	0.16	0.00 016
Half of copper shunt	0.00 070	0.00 000 070

The large G. S. shunt in air often showed

from 1 to 3 units deflection, sometimes in one direction and sometimes in the other; but when placed in water this error was reduced to a much smaller amount, and seldom could be detected. At one time there seemed to be a variable deflection, which was traced to the contacts in the screw connection used to join the galvanometer leads to the shunt wires; this was easily removed by bending the wires until the clamps were under water. After this I could never detect any deflection caused by thermal action in this shunt, although owing to the low resistance of the shunt an error of 0.05 per cent. would cause so small a deflection that it might pass unnoticed.

The copper shunt, with its different terminals, proved very interesting, and exhibited a great variety of thermal action which would, in many cases, be too large to be neglected if the shunt was to be used for comparison of currents.

The largest deflections were always found with the German silver wires, and the least with copper wires with soft-soldered connection. The deflections were seldom twice alike even with the same wires, ranging from 0 0 to 20., being positive at one time and negative at others. The difference between the silver solder and the soft solder was not particularly marked, but seemed to be in favor of the soft solder, both with the copper and German silver leads. These deflections were always smaller and more regular when the shunt was in water than in air. It often happened that the copper soft-soldered leads gave no indications of thermal action, and I never saw any indication of trouble from the double-soldered connection in the middle of the shunt.

This shunt was made to correspond approximately to some of the shunts described in articles on the shunt method of determining currents, both in regard to size and length of wire, and method of connecting the lead wires.

The thermal action in the standard G. S. shunt was very much greater than in any part or combination of the other shunts, being larger when the copper leads were used by about 7 per cent.; still, even these large thermal E. M. F.'s were quite small when compared to that produced by the calibrating current, and could have been safely neglected if an accuracy of 0.1 per cent. was required. I thought I could now compare this shunt with the standard ohm easily enough; and then with the other shunts by using a current of several amperes, to get so great a difference of potential that the thermal effects would be drowned. I changed the storage battery, letting the current pass through all three shunts, and after a few hours I broke the circuit, and tested the shunts to see whether the current had perceptibly heated them, although a sensitive thermometer showed no change. The copper and large G. S. shunts seemed about as usual, but the standard gave me a deflection of 2,000, which rapidly diminished. This was far too small to be of any effect with this particular shunt, but it was very suggestive. Examination of the shunt showed a slight blackening at the positive end, and a few bubbles of gas, probably due to slight decomposition of water, as the difference of potential had been about 1.8 volts. A reversal of the current caused the blackening to appear at the other end of the shunt, and a slight lessening of the discoloration produced by the previous current.

A current of 22 amperes in all three shunts produced 3.5 volts in the standard, and in breaking 0.00 06 volt at the end of half a minute, which fell to 0.00 000 2 at the end of five minutes. The deflection was in the same direction as when the current was passing, and was reversed by reversing the current. The other shunts gave no such effects even with sixty amperes, so work was chiefly on this shunt. A current of 45 amperes caused an effect which sent the spot off the scale for over a minute.

Curves were plotted, showing the diminution of the thermal effect at equal intervals of time after stopping the main current, which show that while the current is passing, the apparent resistance of the shunt is greatly increased by this action. It appears as if this counter electro-motive force increased with the current, although not quite in the same proportion.

At this point my experiments had to be postponed, so all apparatus was put aside for a number of months, and then set up in exactly the same manner and position, with the exception that I only used the standard German silver shunt, to which I added three new sets of terminals—two of German silver and one of copper, all soft-soldered, using acid for a flux.

Experiments were made to find what caused the variable deflection from this shunt after a current had been passing, and to see if there was any noticeable difference in the materials used in the potential leads and solderings.

I designated the different sets of leads in the following manner:

Leads No. 1	were of	German silver,	soft-soldered.
" " 2	"	Copper,	"
" " 3	"	German silver,	"
" " 4	"	Copper,	silver-soldered.
" " 5	"	German silver,	"

When the shunt was in air, the effects—due to thermo-electric action arising from the slight differences in temperature in shunt itself previous to the passage of a current—were found to be of such a magnitude as to be negligible in a shunt of so high resistance as this one, although far too great to be permissible in a shunt of a resistance corresponding to those generally used. These thermal electro-motive forces varied both in sign and amount from zero to 0.00 000 12 volt, and having as an extreme variation about 0 00 000 24 volts. In this respect the German silver leads were anywhere from two to five or more times as bad as the copper, and the too soft-soldered ones seemed to be best, although not enough so to make any marked difference in the readings, which were very small at most. The difference between the copper leads was not appreciable.

With the shunt in air, I allowed various known currents to flow for five minutes, and then took several series of readings every quarter or half minute for about five minutes or longer, if necessary, to see what effect was produced in the shunt by the passage of the current. When the currents were only two or three amperes there was no effect produced large enough to notice; and as I could readily detect an electro-motive force greater than 0.00 000 04 volt the action, if any, must have been very small. With currents that produced a perceptible warming of the wire, I found a great variety of effects, differing even in the same set of leads at different times.

Curves were plotted, showing the effect produced by a current of 24.2 amperes in the shunt for five minutes. The sets of wires called No. 1 and No. 3 were made of the same piece of wire, and soldered at the same time with the same solder; and yet they vary in a very peculiar way, for which I have no explanation except that the composition of the German silver shunt has been acted upon by the solder used, and that in the short length (about two inches near each end), where the soldered joints are, the metal is not homogeneous.

The greatest deflection shows the electro-motive force to have been 0.00 002 volt. Both sets of copper wires act in a similar manner, and give curves which rise quickly during the first half minute, and then gradually drop. Terminals No. 5 give a curve which begins high and falls sharply, and recovers slightly only to fall again. The curves of No. 3 fall rapidly at first, then rise in a regular and very marked manner, after which a fall takes place. Terminals No. 1 do not give especially marked curves, unless it be on account of the much smaller deflections than any of the other wires.

I next placed the shunt in water, and examined it the next morning before passing any current through it, and found a large deflection of 105 units, corresponding to 0.00 004 2 volt. There was a slight difference between the various leads, generally about 5 per cent., but all deflections were in the same direction. I was careful to see that all parts of the shunt were under water, and that the soldered junctions were at nearly the same depth, but still the deflections remained. A current of 25 amperes was sent through the shunt to see if there would be a similar action to that when the shunt was in air, but upon connecting the galvanometer the deflection was entirely off the scale for five minutes, and lasted for an hour. I found that a current of less than an ampere in the shunt, but in the opposite direction, would reverse for a while the remains of the effect due to the 25 amperes There was no apparent difference in the leads, and as the deflections were reversible by reversing the current, and always opposite to those produced directly by the current, I concluded that there was an electrolitic action caused by the current. The positive end of the shunt always turned black, and the negative end tendered to become white. I found that by carefully timing duration and direction of currents, I could get a right deflection which would diminish and a left one begin, which would in turn give way to another right deflection, but I was not able to get four changes. With the soldered ends entirely out of water the actions were exactly the same; but the moment the *whole* shunt was out of water all action ceased, and the deflection became very small; even ten inches of submerged wire gave the deflection, though to a lesser degree, as did also a wet rag wrapped around the wire for a short length.

A current of less than an ampere would produce less than 0.2 volt at the terminals, yet I could get these effects by it, so that simple decomposition of the water was not the cause of the trouble, which it seems to me must be attributed to a "polarization" effect. Having found the cause of the strange deflections when the shunt was in water, I did not continue the experiments any longer. The reason the large German-silver shunt did not show such trouble is, probably, that it had been carefully shellaced when made, and was protected from the oxidizing action.

In the light of these experiments, it seemed desirable to plan a shunt and galvanometer for use in comparing currents ranging from 1 to 1,000 amperes, which would not be affected by either thermal electro-motive forces in its circuit or in the shunt itself. These data were assumed, and the galvanometer calculated.

Calibrating current to be 1 ampere.

Largest current to be 1,000 amperes.

Resistance of shunt to be 0.001 ohm.

E. M. F. at terminals when calibrating 0.001 volt.

Largest observed themal E.M.F. 0.00 000 8 volt.

Average observed thermal E. M. F. about 0.00 000 08 volt.

Galvanometer current when calibrating to be less than 0.001 ampere.

Galvanometer coils to be 25 ohms of German silver wire.

Deflection to be 10 c. m. at 1.5 meters, or about 2°.

Earth's field alone to be used.

Required dimensions of galvanometer.

The field due to the coils must be 0.006 in order to produce a deflection of 2° where H. is 0 1717. The current producing this field would be 0.00 000 4 absolute unite; 25 ohms of No. 18 B. & S. German silver wire would be a length of 8,440 c. m.

Then raidus of coil $= \sqrt{\frac{8,440 \times 0.000004}{0.006}} = 2.37$ c. m.

Average length of a turn $= 2\pi r = 14.9$ c.m.

Number of turns $= \frac{l}{14.9}$ 566 or 283 per spool.

15 X 19 turns give a coil section 0.604 X 0.766 inch.

The galvanometer was made of a single copper casting, with two channels for the coils, 0.2 inch apart. Each channel was 0.77 inch deep, 0.61 inch wide, and had an inside diameter of an inch. If the galvanometer is much lower than 25. ohms, the variable plug resistance of an ordinary bridge will cause an error too great to be safely neglected when only the galvanometer, leads and plugs are in circuit. The reason for the other numerical figures are almost self-evident.

The shunt itself I would make of thin sheet German silver, with either copper or German silver end blocks, as was most convenient, but preferring copper. The lead wires to the galvanometer would be of copper, either soft or silver-soldered to the end blocks, and should go to a commutator very near the shunt itself, and the galvanometer circuit so arranged as to be easily disconnected from the shunt and placed in a mercury cup to close the circuit for the resistance measurement. I would prefer to measure the total resistance by a standard bridge always connected and kept at a constant temperature.

This kind of a shunt could easily be made so that there would be very little heating, and if shellaced, or protected from oxidation in any other manner, could be used in water, although some kind of oil would probably be better.

There should be suitable mercury cups arranged so that the current could be easily and quickly reversed in the shunt, or the shunt entirely disconnected from the circuit.

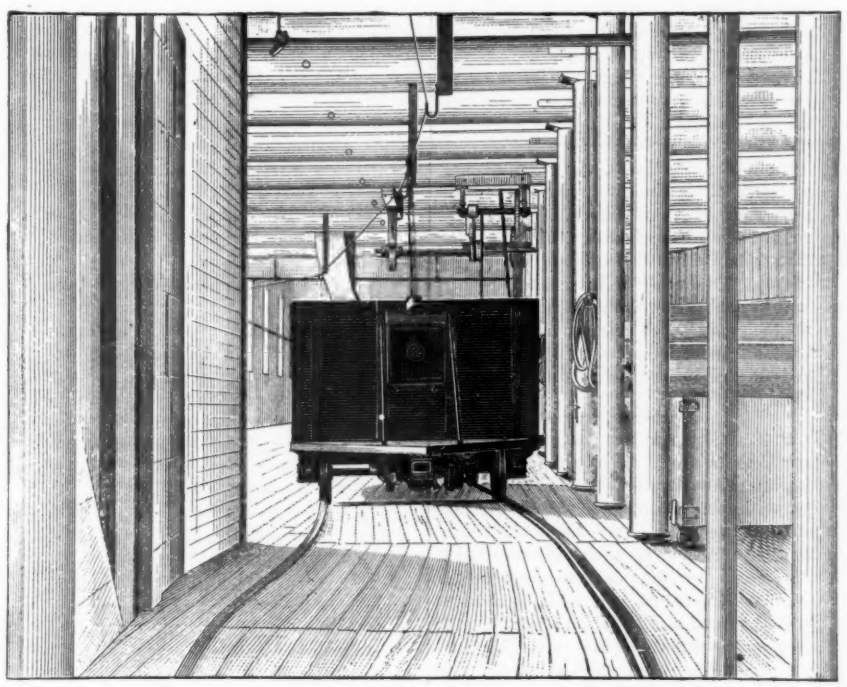


FIG. 2.—ANOTHER VIEW OF CAR AND TRACK.

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☞ No attention will be paid to communications without the *name and address of the writer.*

We invite correspondence from Electricians, Inventors, and the Telegraph and Telephone fraternity and those engaged in Electric Lighting, on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

Timothy W. Sprague, Massachusetts Institute of Technology, is our representative at Boston, Mass.

Mr. C. C. Haskins, 118 La Salle Street, Chicago, Ill., represents the REVIEW in the West.

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The government case against the Bell Telephone company, which was appealed from the Massachusetts courts last autumn, has been set for hearing in the United States Supreme Court for Oct. 9.

We call our readers kind attention to what our English cousins have to say of the changed REVIEW, published in another column. There is a spirit of sincerity in these fraternal compliments from abroad that makes them truly welcome.

We can't see just where the benefit will come to the public or to the Knights of Labor —which organization is petitioning Congress —by the Government entering the telegraph business. The scheme may result in great benefits to every inhabitant of this globe, but we can't see it.

Mr. C. A. Coffin, vice-president of the Thomson-Houston Electric Company, is taking a fortnight's well-earned rest at Old Point Comfort. There is not a more industrious or more potent worker in the electrical business than Mr. Coffin, nor one who has had more to do with the wonderful commercial development of this great industry.

London *Invention* issued a particularly interesting "Electrical Cartoon," March 24th, in which appeared the faces of the famous English electrical electricians and a few of this country. Our esteemed contemporary quite often gets out supplements of this kind representing various industrial fields, and in each instance the work is most creditable and valuable.

Prof. Wm. D. Marks, civil engineer and professor of dynamical engineering in the University of Pennsylvania, has been appointed one of the four experts to examine that widely advertised enigma, the Keeley Motor. The result of the inspection shall only be made known to the effect whether or not the motor which inventor Keeley is now working upon, is the same apparatus that he is alleged to have assigned to Bennett C. Wilson in 1869.

Prof. Roberts-Austen, in a paper presented to the Royal Society, describes some important investigations into the mechanical properties of certain alloys that are not without interest to electricians. The tenacity of pure gold is, he found, very much diminished by the smallest mixture of impurities, and that it is so in accordance with the position of the element in the table of atomic volumes. Thus those elements, the atomic volumes of which are higher than gold, greatly diminish the tenacity of the precious metal.

A French inventor has applied the miniature electric incandescent lamp to watch-dials, the current being supplied by a small pocket battery. The dial is of ground glass, and the lamp behind it lights it up, the effect being enhanced by a flat reflector. A key is included in the circuit to close the current when the light is required. It is obvious that there are circumstances in which such a device will be useful, and where it is inexpedient to strike a light to see the time—such places as mines, or in military operations. The apparatus is equally applicable to clocks.

The Boston Aldermen granted the petition of Henry E. Cobb, R. M. Pulsifer and F. R. Chapman, on Monday evening, for leave to construct and maintain underground conduits in which to conduct wires for telegraphic, telephonic, electric lighting and power communication, in the streets of Boston. This matter has been the subject of many hearings and much discussion, and the action of the aldermen was naturally awaited anxiously, and has caused a great deal of comment and criticism. A minority report was presented also, in which the action taken is protested against as illegal. The daily papers are full of interviews on the subject with insurance men and others, whose views seem to be widely diversant. It is reported that Mayor O'Brien will veto the order, but it was practically passed by a two-thirds vote, seven to three, with two pairs. The mayor is evidently opposed to the plan.

A PATENT SYMPOSIUM.

"I tell you, sir, the Patent Office ought to be reformed, every man of them turned out, from the least unto the greatest, and the law altered so that a patent would be good for something!" The speaker was one of these overgrown noisy men with bulbous form and bawling voice, loudly giving his opinions in one of the hotels on Union Square, where electricians do congregate. He said that he came from the State of Kansas, and some accident of hospitality had evidently brought him very nearly into another state—the penalty for which in Kansas is, we believe, death for the first offense and dissection for the second. The results were limited to making him slightly loquacious without further disabling his faculties.

A cool young man inquired if he was interested in any patents.

"Why, yes, that is my business; I am a professional patentee, Col. Grumpus Bloward, of Yates County, sir; I was the first inventor of the telephone; it was in the spring of '37; I didn't make one, but I said at the time that the telegraph was very good, but they ought to talk by telegraph; I conceived the idea and therefore made the mental effort, yet they would never have given me a patent. I was told two years ago that it was no use to apply for a patent; and see what this grasping monopoly of a telephone company now holds!" [The last in the best tones of his voice.]

"Did you fully recognize the value of such an invention accomplishing the electrical transmission of speech?" asked the young man.

"Certainly I did, and never lost sight of it, either. I knew that it was worth millions and millions."

"Ever buy any telephone stock?" was the next interrogatory.

"Now, young man, that has nothing to do with the question, and I don't wish you to try and dodge the subject in that manner! As I was going to say, I invented a perpetual motion, and put in my application for a patent; and what do you suppose they did? What do you suppose they did?" [Second time, voice *fortissimo crescendo.*] "They sent back papers and money with a letter written by an understrapper, and signed by some chief cook, saying that the office did not recognize that the subject was within natural laws, and that it was therefore beyond the scope of the office and the application could not be entertained by them. It was an infringement of my rights as a citizen. They ought to give every one a patent and one that would be good for something, so that there would be no suing and infringing."

"Suppose that some one would apply for a patent on some invention for which you had received a patent?" asked the young man.

"Why, the office would have to throw it out," was the reply.

"Well," pursued the inquisitor, "what would you do if some one should 'make, rend, or use' your invention?"

"Shut him up at once!"

[Very savage this time, suggestive of retrogressive revolution. No scalping done however.]

"Possibly without due process of law or bringing the action and proving the infringement?" asked the young man.

"I said once that the government ought to make a patent always good, without obliging people to go to law. Not half of the patents are good for anything in the courts."

"That matter has been looked up," said the young man, consulting a memorandum book, "and the records of the decisions of the United States Courts on patent issues from 1776 to 1886, as given in Meyer's Federal Decisions, show that 73 per cent. of the patents were sustained and 27 per cent. of the patents were annulled. Of those which were sustained, 67 per cent. were valid in their entirety and 33 per cent. were sustained in part. In later years the percentage of valid patents are largely in excess of the average result, owing to the decisions which have established every phase of patent law, and also the higher class of men which have been engaged in the solicitation of patents.

"The majority of patents possess a stability of value which will compare favorably with that of personal property in stocks, but any lack of value in patents cannot be ascribed to defects in the legal status of the patents, but to the lack of skill in the patentees whose inventions are either inoperative or not suited to any practical purpose to a degree superior to present methods.

"The art of inventing consists in finding out what is wanted, and then making something to fill that want. By reason of inventions protected by patents, I have been prosperous, receiving at thirty-five a larger annual income than the aggregate amount obtained by my father during a pastorate as long as my life.

"No one has been defrauded, no one has been made poorer, while labor has been made lighter and production increased, giving additional resources to those who would have lacked.

"If there had been no patents, I should not have thought; if I had not thought I should not have invented, but would have been a laborer—a hewer of wood and drawer of water.

"The moderate pay and the defects of the civil service in regard to appointment and promotion render it a wonder that the vast deal of work imposed by law upon the patent office can be so well and so faithfully performed. It is but in the nature of things that there is opportunity, even need of reform, but it must be the kind of reform which improves and not the kind of reform which destroys.

"Concede everything alleged against the United States patent system, and then name the nation whose patent system you would take in exchange."

This gentleman, who had joined the group unannounced, departed unattended, while a young stenographer who had reported the discussion without being observed, wrote it out and submitted the foregoing credentials accompanying an application for employment in the office of the ELECTRICAL REVIEW.

THE NEW ENGLAND ELECTRIC EXCHANGE.

The New England Electric Exchange was formally inaugurated at the meeting held on Monday last, at the rooms of the Electric Club, Boston, President Alexander in the chair. The committee appointed at the preliminary meeting made a report which embodied the proceedings of that meeting and gave an account of many conferences held by them with the representatives of the fire insurance interests, in reference to the matter of licenses being granted by the Exchange to persons practically engaged in installing or operating electric plants, with the object of inducing the fire underwriters to recommend the introduction of electricity in preference to other means for producing artificial illumination and for power. The report was accepted and a constitution also presented by this committee was adopted by the meeting. In regard to licenses the committee reported that—

In order to promote ambition in excellence of workmanship and extent of knowledge among men practically engaged in installing or operating electric plants and to thus make it an object for fire underwriters to recommend the introduction of electricity in preference to other means for producing artificial illumination and power, the New England Electric Exchange will issue licenses under the following general plan.

Licenses shall be of five classes, each class representing a certain extent of qualification.

First class licenses shall be issued only to persons fully qualified to install and operate any electric light and electric power plant.

Second class licenses shall be issued only to persons fully competent to install and operate any two of the following plants, viz, incandescent light, arc light, or power.

Third class licenses shall be issued only to persons fully competent to install and operate any one of the following plants, viz, incandescent light, arc light, or power.

Fourth class licenses shall be issued only to persons fully competent to operate electric machinery and who are not competent to do electric wiring.

Fifth class licenses shall be issued only to persons fully competent to do electric wiring and who are not competent to operate electric machinery.

Any persons desiring a license shall make formal application to the secretary of the Exchange specifying the class of license desired, these applications shall be referred by the secretary to the directors who shall select three persons to examine the applicant and report upon his qualifications.

The examiners shall appoint, for the examination, such time and place as may be deemed by them advisable and the applicant shall appear before them at such time and place for examination.

The examination shall be such as to satisfy the examiners as to the fitness of the applicant for either the license applied for or for one of another class.

All licenses shall be properly filled out with the class of the license, name and qualification of the licensee, certified to by the examiners, submitted to the New England Insurance Exchange or to the Boston Tariff Association (as the case may be) bear in token of their approval the signature of one of their inspectors, and then be dated and issued under the seal of the Exchange.

A license shall be valid for one year from its date, but the licensee may apply within that time for examination for a license of a higher class.

The directors of the Exchange may, for cause, revoke any license granted by the Exchange.

All applications for license must be accompanied by two dollars ($2.00) to help defray expenses, and must bear the signatures of two members of the Exchange.

This plan, as presented by the committee, was adopted by the Exchange. Mr. Frank Ridlon stated that the insurance people had stated not only a willingness but a desire to co-operate with the Exchange in the matter of licensing employees. The more or less rambling discussion before the final adjournment showed the great possibilities for doing a good work in the advancement of electrical interests and science, which the Exchange possesses. The board of directors, as legally elected under the constitution, consists of P. H. Alexander, president; H. B. Cram, secretary-treasurer, and Robert Amory, Frank Ridlon, George W. Davenport. A meeting of the directors was held on Saturday, and the details of the matter of licensing, etc., are being rapidly arranged. The membership roll already contains a majority of the names prominent in the field of electrical installation and operation in Boston and from all over the New England States.

OUR BOSTON LETTER.

(Special Correspondence.)

The Jarvis Engineering Company are putting in the steam plant for a 160 horse-power Edison central station at Newport, R. I. It is to be in operation next July. The company is also supplying the complete steam plant for the Meriden central station of the Daft railway.

The Thomson-Houston Co. has sent out four men recently to make installations of its apparatus in far away places. They sailed in the Pacific Mail S. S. "Colon" on Wednesday. C. W. Grant and W. C. McEntee, go to Panama, P. Burbank is bound for Lima, Peru, and C. B. Davis will make Guatemala his destination. Mr. G. W. Davenport, general manager of the T.-H. International Co., accompanied the party as far as New York.

The Thomson Welding Company has been incorporated with a capital of half a million dollars. The directors are Gen. W. F. Draper, of Hopedale, president; B. F. Spinney, of Lynn, treasurer; J. N. Smith, Prof. Elihu Thomson, H. A. Royce.

At the annual meeting of the Thomson-Houston Co. on Monday, the treasurer's report was read and accepted and the former board of directors unanimously re-elected.

The next dinner of the Electric Club will be held at Hotel Thorndike, on Saturday evening next. Mr. William O. Webber, will read a paper entitled "The Advantages of and the Methods for Testing Engineering Materials."

PERSONALS.

N. T. Pulsifer, General Manager of the Mather Electric Co., was in the city to attend the meeting of the N. E. Electric Exchange.

Other prominent electrical visitors during the week were M. W. Mead of Pittsburgh, Henry D. Stanley and George T. Manson of New York.

Mr. C. J. Vanderpoele is making elaborate experiments with the T.-H Company, developing and perfecting his system of motors for railway companies. Capt. Eugene Griffin, U. S. A., engineer, has assumed charge of the motor and railway department of the company. T. W. S.

Boston, April 16.

OUR CHICAGO LETTER.

(Special Correspondence.)

Davenport, Iowa, has a Central Street Railway, and the C. S. Railway has a Sprague motor system contract just closed by Mr. C. M. Barclay, of Chicago. The generators are to be driven by two large Corliss engines, and will be six in number, of 50 horse-power each. The cars are to be lighted by incandescent lamps—five to a car—which the evening press thinks will be a great convenience to people carrying home an afternoon paper.

The cost of the plant is to be about $42,000. The present equipment calls for eight cars, six of which are to be running by the first of July.

Mr. George E. Sutton, an employee in the electrical department of the Western Electric Company at Chicago, was instantly killed by falling down the elevator shaft at the works of the company, on the night of the 10th instant. Mr. Sutton had charge of the electric light plant at the works, and was making a round of inspection, having gone to one of the upper floors for that purpose on the elevator. The elevator was not entirely stationary when he stepped off, so that when he returned and stepped inside the door, the elevator had gone to its upper limit and stopped. Poor Sutton fell to the basement and was instantly killed.

Mr. Sutton came to Chicago from Philadelphia, was a competent and thorough workman, was well liked by his fellows, and commanded the respect of his employers and all with whom his duties brought him in contact.

Prof. Barrett is busily engaged in formulating plans for a plant to light up Clark street from the river to Van Buren street, and Madison street as far west as Halsted street.

We hear every few days from some one who lives in some small country town, that there are "so few electric lights in Chicago." What principally ails these gentlemen is a failure to consider the question of acreage. The facts in the case are that there is one private establishment in Chicago that is burning, daily, more arc lamps than half a dozen of these suburban towns would require to light up their entire fenced-up portion of God's heritage. Marshall Field & Co., for instance, have 210 arc lights and 500 incandescent lamps aflame six days in the week.

A little one-horse plant on the West side is running 120 lights of the arc variety. There are two or three of that kind, and plants with 40 to 60, inside the four walls of a mercantile establishment are by no means rare.

The Arc Light and Power Company is running between 1,500 and 2,000 arc lamps, and the Edison central station will, in a few weeks, be furnishing current for between eight and ten thousand incandescent lamps, from a power station now nearly completed.

The Thomson-Houston people are lighting up the exhibition of two celebrated paintings, "Christ before Pilate" and the "Ten Virgins," in Chicago, with series incandescent lamps, on a circuit run by the Arc Light and Power Company. The advantage of electric illumination over gas, and especially over that variety known as "Chicago improved" gas, can hardly be over-estimated.

The Electrical Supply Co. has recently issued a number of new classified catalogues, so that a customer for wires, metals, cables, etc., will not be required to carry a huge bundle of unavailable matter to fulfill his requirements; another tells all about bells, annunciators, batteries, pushes, etc.; there is one expressly for the searcher after information on electric plant construction, and a telegraph student's instruction book, worth as much as, and very much cheaper than, a telegraph institute scholarship. These catalogues, etc., are for gratuitous distribution, and will be sent to the address of those asking. That wire with the mysterious initials, the "P. & B.," is sold by the Electrical Supply Co., and as a substitute for the old-fashioned T. & B.—tricky and base—underwriter's wire, is a grand success, and meeting with a good demand.

Underwriters' wire does not find a ready sale for outside work in Chicago.

Chicago, April 16, 1888. C. C. H.

Personal.

Mr. Fred. Boynton, treasurer of the Boston Electric Club, was a New York visitor last week.

Mr. Elmer A. Sperry, one of Chicago's bright young electricians, was a New York visitor last week.

Mr. Frank Ridlon, of the Baxter Motor Company, Boston, has been a New York visitor for several days.

Mr. R. T. McDonald, the energetic head of the Fort Wayne Jenney Company, is sojourning in the east, with headquarters at the Grand Central.

Mr. Geo. W. La Rue, formerly with the C. & C. Motor Company, has accepted a position with the Sprague Electric Railway & Motor Company, 16 and 18 Broad street.

F. H. Twitchell, of Bath, Me., a leading wool manufacturer, and a large holder of electric light properties, is visiting New York, with headquarters at the Brunswick.

Prof. F. B. Badt has been in New York for several days meeting his numerous eastern friends. Should he decide to locate here, Chicago will have lost one of her best electricians.

Mr. John I. Sabin, of San Francisco, who has been an eastern visitor for a few weeks past, returned to his Pacific Coast home last week. His friends regretted that his stay was not longer.

Electrical men can be counted on to win every time. Mr. E. H. Johnson, president of the Edison Electric Light Company, carried off the honors at the exhibition given by the New York Riding Club last Saturday evening.

Dr. George H. Benjamin, the well-known scientific expert and electrical engineer, has organized Benjamin's Scientific Expert Office, at 35 Wall street, associating with him David W. Brown, Ph. D. This will be a scientific expert office worthy to be so-called, composed of able, thoroughly well-informed and experienced gentlemen.

Mr. C. G. Sholes, of Chicago, has resigned his position as superintendent of the Chicago and Milwaukee Telegraph Company, and has been appointed superintendent of telegraph of the Chicago, Santa Fe and California Railway, with headquarters at Chicago. Mr. F. E. Crawford will fill the position vacated by Mr. Sholes.

Mr. Chas. E. Topping, for many years general superintendent of telegraph and express on the Long Island Railway, has resigned to accept the position of general superintendent of the U. S. Express Company of the Jersey Central system. He was presented with a magnificent silver service on leaving by his fellow officers and employees.

Mr. Albert C. Dam is a New York visitor this week, making his final preparations for managing the fine restaurant of the new union station in Portland, Me. This magnificent new building is lighted by the electric light, is a great dining point for passengers from New York to Bar Harbor, and it will be a source of pleasure to many to learn that an accomplished New York hotel man is in charge.

Prof. A. Reckenzaun, after a nine months' visit in the United States, during which time he made a large number of friends among electrical people here, sailed for England last Saturday on the "Etruria." Professor Reckenzaun has devoted himself largely to the development of the storage battery while in this country, and has been a valuable aid to the Electrical Accumulator Company of New York.

Mr. Frank B. Knight is in Texas and is just now, in addition to telephone duties, taking an interest in the great Military Encapment, to be held in Austin, Texas, next month. We have received several illustrated papers relating to the Encampment, and in one the figure of the valiant Knight may be seen wearing a wide spreading sombrero and sitting gracefully astride of a Texas mustang, surrounded with luxuriant cacti, as much at home as if to the manor born. Texas is a great State, and those, like Knight, who like it at all are said to like it like all possessed.

Boston has ventured into the uncertain realms of the question of underground wires. We shall await with interest the outcome of the vexatious problem in the city of culture, beans, brown bread and art.

What Our English Cotemporaries Think of the Improved "Review."

[*From Engineering, London.*]

We notice with pleasure the development of our American contemporary the ELECTRICAL REVIEW, a development indicative of increasing prosperity. With the commencement of its thirteenth volume, it has been permanently enlarged, and the value of its contents is increased by additional illustrations, and more varied subject matter.

[*From Industries, London.*]

The current number of the ELECTRICAL REVIEW of New York commences the thirteenth volume, and a new departure has been made by the addition of a colored cover, the front page of which bears a bold design, which is free from all advertisements. The issue contains a number of interesting articles, is well illustrated and printed, and several improvements have been made in the arrangement of the letterpress.

[*From Electrical Review, London.*]

NEW YORK "ELECTRICAL REVIEW."—The appearance of our valued namesake in a bright new dress took us by surprise last week. The colored cover, with well-displayed title, is a great improvement; and we are pleased to see that our contemporary has not stopped at the ornamentation of its exterior, but has added new departments and more columns inside. We wish it continued success.

[*From The Electrician, London.*]

The prosperity of electrical business, and consequently of electrical journalism in the United States, is indicated by the enlargement and improved appearance of such papers as the New York ELECTRICAL REVIEW, which this month starts a new series with an artistically designed wrapper and a wider range of contents.

[*From the Telegraphist, London.*]

THE NEW YORK "ELECTRICAL REVIEW."—A handsome wrapper has just been added to this admirably-conducted journal, which gives a faithful record in popular language of the doings of the electrical world. Too much praise cannot be awarded to the management of the New York ELECTRICAL REVIEW for the lavish manner in which their journal is got up for the attraction of students of our fascinating science.

[*From Invention, London.*]

SUCCESSFUL JOURNALISM.—The current number of our excellent contemporary, the New York ELECTRICAL REVIEW, which journal has just entered its thirteenth volume, is greatly improved. A cover, with a striking front—on which no advertising matter is permitted—has been added, as well as several new departments intended to more thoroughly represent and classify the new fields in which electricity is becoming an important element. In this issue appear illustrations and descriptions of many important electrical enterprises, notably long-distance telephoning and incandescent lighting on a very extensive scale, besides numerous scientific and practical articles, grouped under appropriate headings. It is now an excellent twenty-four page paper, exclusive of cover, without padding or extra effort, and we have much pleasure in congratulating our contemporary on its success.

The thirty-eighth exhibition of paintings at the Boston Art Club is now open. The colors and shadings of the pictures are very well brought out by the incandescent lamps used for illumination. This was the first art gallery in the world to be permanently lighted by electricity, though at the exhibit of the Charitable Mechanics' Association, three years ago, incandescent lights were used in the Art Gallery and since then the Grosvenor Gallery in London has been so lighted. The N. E. Weston System is used.

The Southern Telegraph Case Settled.

Judge Duffy, in the Circuit Court in Baltimore, last week, decided the case of the Southern Telegraph and Cable Company of New York against the United Lines Telegraph Company, Francis P. Stevens, William A. Dunn, and others in favor of the complainant. The suit was brought in July, 1886, by the complainant corporation to have the property of the Bankers' and Merchants' Telegraph Company, which was sold by the receivers in December, 1885, conveyed to this company, it having paid the entire amount of the purchase money, $25,000. Owing to a misunderstanding at the time of the sale the receivers insisted upon reporting the United Lines Telegraph Company as the purchaser. The suit was brought to correct this, and was resisted by the defendants on the ground that they were creditors of the United Lines. Judge Duffy decided that the Southern Telegraph and Cable Company was the real purchaser of the property, and passed a decree directing the property to be conveyed to the complainant, free from all claims of the defendant.

TELEGRAPHIC

.... The Hotel Luehrmann just opened at Memphis is provided with the best electrical arrangements, done under the supervision of Mr. D. E. Goe, the electrician for the Western Electric Company of Chicago.

.... The North Franklin Telegraph and Telephone Company have voted to build a telegraph line from Strong to Eustis, Me., and twelve hundred dollars has been raised for its construction. This will open up to the outside world the sporting resorts of the Dead River region. Committees have been appointed, and the work of construction will begin so as to be completed before the opening of the coming season.

.... A galvanic battery forms the subject of two patents issued to Mr. Horatio J. Brewer, of New York City. A new and useful improvement in porous cup batteries is provided by these inventions, the construction being such that the electrodes are securely seated in place, and the gases forming in the porous cup can readily escape, so as to prevent the adhesion of insulating bubbles on the negative electrode, and its polarization, thereby rendering the battery very effective at all times.

.... The apparatus for the electric fire alarm system for Columbia, S. C., has arrived. Mr. J. D. Easterling will superintend the arrangement of this electric service and will begin work at once. It is probable that in less than two weeks Columbia will have in operation the electric fire alarm, something which has been sorely needed for years. The alarm telegraph wires will be strung upon the telegraph and telephone poles wherever convenient, and when these poles cannot be used new ones will be put up.

.... Gardner G. Hubbard addressed the Senate Committee on Interstate Commerce last week, in regard to the Interstate Telegraph bill. He advocated two amendments to that measure: First to prohibit all telegraph companies from making stock dividends, and providing that the capital shall not be increased except for the par value of the stock paid in cash or for lines purchased at a valuation to be approved by the Commissioner of Interstate Commerce; second, providing that telegraph rates for shorter distances shall never exceed those for greater distances. He told the financial history of the Western Union Telegraph Company at considerable length, setting forth that an investor having one thousand shares in 1863 had increased his shares to eight thousand in 1881, as a result of stock dividends, without having paid in more than the original investment. An original investment of about $10,000,000 had been capitalized at $86,000,000, and the increased value had all been paid by the patrons of the telegraph. He stated that investments had been made by the Western Union directors for their own benefit, which were not in the interests of the stockholders, and cited in illustration the lease of the Atlantic cables laid by Jay Gould and others at an expense of between two and three millions, and leased to the Western Union on a basis of five millions, while at the same time the property was operated at a loss, or at best a very trifling profit. He charged that the Western Union has never been managed in the interest of the people, and that while it might be true, as claimed, that a private line would be managed more economically than one owned and operated by the Government, yet the economies were all beneficial to the owners of the line alone, and not in any degree to the people. The bulk of the business he declared was transacted by the few in the large business centres, and the Western Union's policy was to encourage a small business at high rates. He said that since 1866 the Western Union has received in tolls $186,000,000, that its expenses have been $100,000,000, and its profits $86,000,000. Of this $86,000,000, $47,000,00 have been expended in dividends, $18,000,000 in the construction of new lines, $4,000,000 in the purchase of new lines, $10,000,000 in sinking fund and bonds redeemed, and $7,000,000 in sundries.

The Telegraph in a Poker Game.

There is a gambler in St. Paul who will not try to do up another telegraph operator in a hurry. A night operator in one of the big railroad offices has quite a reputation as a poker player, and as poker was also the favorite game of the gambler, they arranged to have a friendly game. It occurred in the railroad office, no one else being present except the operator on duty. For the first time in his life the gambler's luck did not come to his aid, for his opponent won on nearly every hand, or else laid down when the gambler had good cards. Finally the latter had four kings, made a small bet, and the operator refused to call. That action had become so monotonous that the gambler reached over and scanned the cards that the operator had laid down. To his surprise they were three queens and a pair of tens. "What in thunder did you lay that down on a $2 bet for?" he exclaimed, adding, "I guess I've got enough." The secret of the operator's luck was that the other operator was sitting where he could see the gambler's cards, had telegraphed each card as it was picked up, thus enabling the player to know how to play the game.

How They April Fool Chicago Reporters.

A good April fool story has been floating around City Hall since the first, but as the joke was on the newspaper fraternity, of course the reporters have not published it. Those things are not so funny when we are caught as when the joke is on the other fellow.

There is a representative of each daily paper whose duty is to remain at the fire alarm office at night to report fires.

Now a second alarm in Chicago is a matter of some consequence; but when after a 2–11, a 3–11 follows quickly, everybody knows it's a big fire.

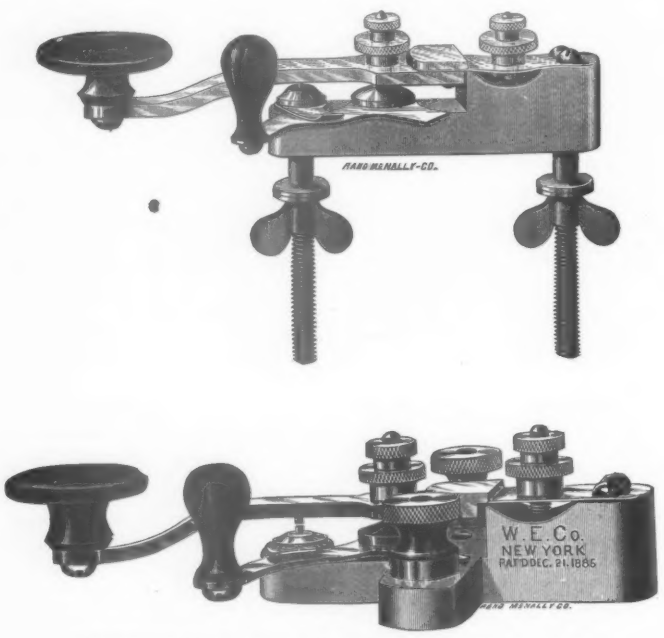
Well, along after 12 o'clock on the morning of the first of April, there was an alarm of a comparatively trifling importance, and no one paid any attention to it. One of the reporters slipped out into the hall, unlocked a gong, and with his hand, and without disturbing the electrical portion, rang a 2–11 and followed this immediately with a 3–11 signal. The reporters went out of that house as if shot from a gun. Each found a telephone and ordered a "wait" on the make-up of the paper, to get in the big blaze, and the cabs surrounding the City Hall had each a fare. By the time the enterprising journalists had arrived at the smouldering remains of a plain, ordinary fire, they gradually discovered that they were a lot of April fools.

* * Some of the heavenly bodies are inclined to be fast. Meteorites sometimes attain a velocity of 180,000 feet per second. When passing through the air at this rate the fricton is so great that the air is heated up to a temperature of 10,800° F.

The Railway Superintendents Inspect the Train Telegraph.

Per invitation of H. Stanley Goodwin, General Superintendent of the L. V. R. R., a number of the members of the North American Railway Superintendents Association and others, made an excursion in a special car over the New Jersey division of the L. V. R. R., as far as Easton, Pa., and back to New York, for the purpose of testing the jumping qualities of the Consolidated Railway Telegraph Company's "Grasshopper."

A number of telegrams were transmitted and answers received concerning closing stocks, Mr. Conkling's condition, resignation of Warden Walsh, Mrs. Dis Debar's arrest, and other news direct from New York; all this while the train was whizzing along at the rate of fifty miles per hour.



TELEGRAPH KEYS OF THE WESTERN ELECTRIC COMPANY.

The following message was sent to Mr. J. W. Lattig, superintendent telegraph L. V. R. R., at Bethlehem:

"Please tell dispatcher Fulmer, at Easton, to be on look out for a car load of dark-browed villains."

To which he replied as follows:

"All right, I will ask Mr. Fulmer to capture them on arrival. J. W. L."

Mr. Goodwin met the party at Easton, and very cordially expressed his pleasure at meeting them again.

The special car, which was a new and handsome one, was side-tracked at Easton, convenient to the line wire, so that there was no interruption in the telegraphic service from the time the train reached the New Jersey division until it left it on the return trip.

On the return to New York the special car was coupled on to the end of the fast train, leaving Easton at 4.23 P. M., and at a point two miles west of Boundbrook, the railway superintendents had a practical demonstration of the usefulness of the "Grasshopper telegraph," due to the fact that the engineer was obliged to stop the train in order to attend to some portion of the engine which had got out of order. This caused a delay of about ten minutes. The particulars were telegraphed to the dispatcher and an order from Superintendent Donnelly for a relief engine to take the train in from Perth Junction to New York was duly acknowledged and arranged for, thus reducing the delay to a minimum.

The railway superintendents were not only very much interested, but some of them, who are old-time telegraphers, handled the key personally and expressed themselves as being satisfied that there is a great future for the system, especially on single-track roads.

Among those present were the following gentlemen: C. S. Gadsden, Pres't North American Ass'n Ry. Supts., Supt. Charleston & Savannah, Ry., Charleston, S. C.; J. B. Morford, Supt. Canada Division, Mich. Centl. Ry., St. Thomas, Ont.; C. A. Darlton, Supt. Tel. Richmond & Danville System, Washington, D. C.; R. H. Wilbur, Ass't to Gen'l Supt. Lehigh Valley Ry., Bethlehem, Pa.; E. T. D. Myers, Gen'l Supt. Richmond, Fredericksburg & Potomac Ry.; L. T. Myers, Supt. Trans. Seaboard & Roanoke Ry., Baltimore, Md.; Chas. A. Gilchrist, Receiver & Supt. F. M. & N. W. Ry., Fort Madison, Ia.; Jas. Donnelly, Supt. N. J. Div. L. V. R. R., Perth Amboy, N. J.; E. H. Goodman, U. S. & S. Co., Pittsburgh, Pa.; C. A. Scott, U. S. & S. Co., Boston; Wm. E. Gleeson, Chas S. Peck, Jos. J. Meeker and J. D. Baker of New York; Henry D. Hall, Secy. & Treas., and S. K. Dingle, Asst. Supt., C. R. T. Co., N. Y.

Copper Pipes Made by Electrolysis.

The recent accident to the steam-pipe of the steamship "Elbe" lends a special interest to the electrolytic process for the manufacture of copper now being practiced by Mr. W. Elmore at Cockermouth. The London *Engineer* says that by this method such an article as a steam-pipe can be produced without weld or joint, and having a tensile strength from 50 to 100 per cent. in excess of first-class brazed pipes. Further, this result can be attained with the use of a very inferior quality of copper, and at a cost which will enable the electrolytically-made article to compete in the market with the customary varieties. Of course there is nothing new in depositing copper in a tubular form, but hitherto such metal has been too brittle to render it reliable for use in circumstances under which it is exposed to great stress. For copying engraved plates, and for the rollers of calico-printing machines, deposited copper has been used with great success, and when it has been thrown down very slowly it has been possible to produce very satisfactory qualities of metal for these purposes. The novelty introduced by Mr. Elmore, however, lies in breaking down the crystals almost immediately they are formed, and pressing them out into a fibrous form, in which they are interlaced and matted together. To this end the iron core or mandrel on which the metal is deposited is kept constantly rotating in the bath, and an agate burnisher is slowly moved backwards and forwards lengthwise of the cylinder, as if to cut a screw-thread upon it. The speeds are so arranged that a layer of copper seven-thousandths of an inch thick is deposited between each reciprocation of the burnisher. When the required thickness has been attained the mandrel is lifted out of the bath and placed in a vessel supplied with superheated steam. In a few moments the expansion of the copper detaches it from the iron, and the shell can be stripped off. Pieces cut from such tubes have been submitted to breaking tests, and have broken at strains varying from 27 tons to 41 tons per square inch, with an extension varying from 5 per cent. to 7½ per cent. in a length of ten inches. The metal can be worked under the hammer most easily, and can be drawn, bent, or compressed without annealing and without any tendency to crack. Specimens polished and submitted to the microscope show that the electrolytic metal has a perfectly compact and homogeneous structure, while drawn copper is a honeycombed mass of crystals, only connected together at points.

Telegraph Keys.

The key illustrated on this page manufactured by the Western Electric Company is meeting with good favor among telegraphers, and many of them say it is the easiest working key that has ever come to their notice.

There are some novel features about this key. There are no pivot screws to work loose or stick out and get broken off. The adjustment is made by means of a German silver spring on top and not the ordinary spiral spring generally adopted in the manufacture of keys and placed under the lever which is constantly growing weaker and weaker and finally breaks off. Some of these keys have been in use for over a year and are still giving entire satisfaction. They are being largely used by all the leading telegraph and railroad companies in the country. We illustrate both legged and legless styles.

The Underground Question in Boston.

In view of the fact that an order has been passed by the Boston council, granting to three persons an exclusive right for twenty years to construct and own electrical conduits in some fifty of the streets of that city, the following interview with General Thomas Sherwin, president of the New England Telephone Company, will be of general interest:

"How would the passage of the order granting the exclusive privileges to a conduit company to construct electrical conduits in the streets affect the telephone company's interest?"

"In my judgment it would seriously check the work which the telephone company has already undertaken, and in which it has made considerable progress, in the placing of its wires underground. In compliance with the popular desire that the overhead wire system should be lessened, during the past two years we have put in about three miles of underground conduits, which, together with those which we already had, costing, with the cable enclosed, about $70,000, are capable of carrying five or six thousand miles of wire. We have arranged to extend our system, and to expend about $50,000 during the present season. The operation of the proposed order would be to exclude us from occupying many of the streets through which we have arranged to lay conduits, and from making necessary connections with our present system."

"On what system have you been laying wires?"

"Part of our underground system consists of iron pipes laid in cement concrete; part of the creosoted plank conduit, such as is in use in Brooklyn, Washington, Buffalo and other cities. The conduits are reached through manholes of about eight feet in depth, at intervals of about from two to three hundred feet, and from these manholes, the cables are drawn through ducts, the hundred or more wires in the cable ends being joined at each manhole. We are thus enabled to draw in the cables and to remove them when from any cause, such as moisture or accident, they may become unfitted for use."

"Is there any practical difficulty in having different kinds of electrical wires working side by side in the same conduit?"

"There is serious objection to placing the telephone wires in proximity to other electrical wires. Experience has shown it to be disastrous to good telephone service to have other wires working in proximity. More than that, the danger of bringing the high tension currents in proximity to the wires is a very serious one. It is true that the wires carrying heavy currents would be in separate ducts, but it is also true that, in man holes, they would be closely contiguous to the telephone wires without separation, and it is here, as experience has shown, that the danger lies. We should be reluctant to have our men work in manholes in which the wires containing the current for arc lights were carried. The telephone company has relied upon the permission heretofore granted it by the city to place its wires underground. It has expended a large amount already, and it has made arrangements to expend still more money, relying upon the good faith of the city to protect its rights; and to withhold these rights and to prevent it carrying out the plans already made, would interfere seriously with the good results in meeting the wants of the public which had been hoped from the work."

"Is there any case within your knowledge in any city where telephone wires and electric light wires are carried in the same conduit, even though in separate ducts?"

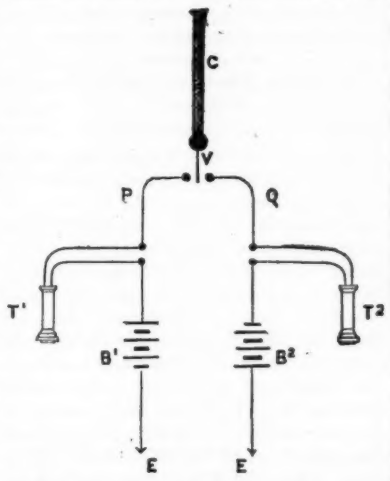
"I am unable to find any case where electric light wires and telephone wires are carried in the same conduits successfully. The experiment has been tried in one or two cities, and always, as far as I can learn, the attempt to work them has been a failure. It is a fact that in the City of New York, where most ample powers have been given to the Board of Electrical Control, they have not yet made the attempt to carry the telephone wires and electric light wires within the same system of conduits."

"From the wording of the order, do you understand that the grantees would be required to accomplish any specified amount of work within any specified time?"

"I do not see that the proposed order puts any requirement upon the grantees to actually prosecute its work so as to make it of value to the wire companies or to the general public."

"Then the result would be that you would be excluded from certain streets and these grantees would be under no obligation to occupy them?"

"I understand that not only the electric companies and the citizens of Boston, but the city government itself, would be precluded for the space of twenty years from constructing electrical conduits in these streets, or from any control of these streets so far as the placing of conduits is concerned, even if the would-be grantees do practically nothing within the twenty years. The grantees could construct conduits or not as they pleased; they could permit wires to be placed in them or otherwise according to



their choice. They could make the cost of occupying ducts in their conduits prohibitory, or so charge as to impose a serious tax upon the owners and users of wires, and through them upon the public. So far as these streets are concerned—and they include most of the important streets in the city, they can absolutely block the further placing of underground wires during the period for which their license is granted. There is no provision by which the city can resume the control of its streets. I am informed further that the grantees under the proposed order have at present no conduit plan to present. The system which the telephone company has already adopted has been the result of a great deal of study, and in the present state of the art it serves our purpose as well as any which we know; to make it a part of another system would ruin it."

"Has it not resulted in disturbing the streets to a very considerable extent?"

"Certainly not. The trenches which we have made have been only about four feet deep; the work has been pushed so rapidly that no spot has remained uncovered more than three days before the pavements have been restored, and though the attempt has been made to create an impression that the streets have been torn up by the wire companies to the public inconvenience, it is not the fact. The deep trenches which were made in Boston last year were not for the purpose of laying electrical wires, but by a company engaged in a totally different business. I am confident that the work done by this company has not been to the inconvenience or detriment of the public in the use of its streets."

"Have you had occasion to dig up the street for the repair of your conduit?"

"Only once, and then only for a distance of five feet. I do not believe it will be necessary for many years to disturb the surface of the streets where our conduits are already laid. The city ordinance provides that the right to lay underground wires may be granted to companies operating wires for telephone, telegraph and electric light purposes. The gentlemen named in the proposed order, so far as has been shown, do not own or operate a wire, nor do they propose any definite plan for constructing conduits. Now it is proposed to delegate to them the control of the streets of Boston, the power which belongs to this and succeeding city governments to exercise. If this could legally be done it would be of no possible benefit to the grantees, who, exercising this large and unprecedented power, responsible to no one but themselves, could use it for speculative purposes, or otherwise, as they pleased. Such a power never has been granted by the city of Boston, and, for the public good, it never should be."

A Sound Receiver for Submarine Telegraph Lines.

Our esteemed contemporary the London *Electrician* speaks of the following method of receiving signals on submarine cables lines by means of the telephone, or rather, by a pair of telephones, has lately been proposed by M. Ader. The author thinks it will be applicable wherever the mirror or Thomson recorder is in use. Whether M. Ader has had an opportunity of actually carrying out the experiment which he describes does not appear; but the ingenuity of the idea will be appreciated, even if it should not prove to be of practical utility.

If a telephone be placed directly in circuit with a submarine cable working a mirror or a recorder no sound whatever is heard, because the rate of variation of the current is too slow to affect the diaphragm sensibly to the ear. And if an electrical or mechanical vibrator be introduced into the circuit, keeping all other conditions as before, we should simply hear the hum of the vibrator, and this would be unaffected by the signals. Suppose, however, that we had two independent telephones, and that the positive and negative currents received upon the cable were directed each into a separate telephone receiver, we should clearly have at least the basis of a method of reading the message by sound.

M. Ader seeks to develop this idea in the following way: In the diagram shown, C is the cable, which is connected with a vibrating tongue, V. The tongue is kept in rapid vibration by means of some quite independent electrical or mechanical device, which is not shown in the figure. The function of the vibrator is two-fold. first to interrupt the current so as to produce sound in the telephone; secondly, to direct the current alternately into the branch P to the left, and into the branch Q to the right, which contain the telephones T_1 and T_2 respectively. This distribution is effected quite independently of the direction of the current in the cable at the moment. But each of the branches P and Q contains also a battery B_1 and B_2, B_1 having its positive pole, and B_2 its negative pole to earth, or *vice versa*. Now, suppose that a positive current is received upon the cable. The vibrator makes, it may be, a dozen or twenty contacts on either side while this current lasts, but if the strength of the batteries be suitably adjusted, the telephone T_2 alone responds to the signal, the battery current being added to that received over the line.

The telephone T_1 is mute, because the current is neutralized in this circuit by that of the battery. The battery current may, of course, be adjusted by the insertion of suitable resistances.

The weak point of this device evidently lies in the impossibility of adjusting the batteries B_1 and B_2, so as to balance the continuously varying currents received over the cable. But, on the other hand, it is quite possible, and even, we think, probable, that an operator would soon become sufficiently expert to read by gradation of sound, although neither telephone was absolutely silent.

M. Ader thinks that owing to the sensibility of the telephone it would be possible to work cables on this principle with smaller cores, and thus effect considerable economics in the construction of new lines.

⁂ The Chesapeake and Potomac Telephone Company have requested permission to substitute asphaltum conduits for wooden ones on certain streets in Washington, D. C.

Telephonic News

⁂ There is a telephone exchange in Hutchinson, Kansas, operating the Cushman instruments.

⁂ Mr. Isaac H. Farnham has patented a granular carbon telephone transmitter, which he assigns to the New England Telephone Company, of which he is the well-known electrician.

⁂ Talk about your policemen in this great city! They can arrest only men and women and children, with an occasional goat or two. But the telegraph and telephone people discount this. They have the gall to arrest the lightning.

⁂ The seventeenth meeting of the American Society of Mechanical Engineers will convene in the city of Nashville, Tenn., on Tuesday, May 8th, at 8.00 P. M., and will adjourn on Friday of that same week. The headquarters and Secretary's office will be in the Maxwell House.

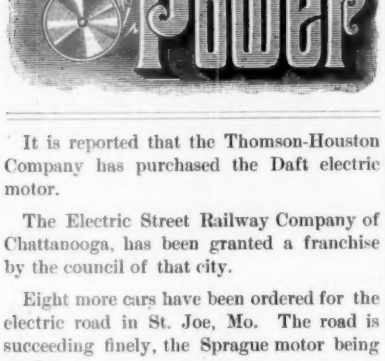
⁂ Mr. E. H. McFall, electrican of the Great Southern Telephone Company, New Orleans, has invented a pocket telephone by means of which a line can be tapped instantly in any part of the city, and the user be put in communication with the central office. The instrument is being practically tested in New Orleans.

⁂ In some English hospitals telephones have been attached near the beds, enabling the patients, without any great exertion or derangement, to receive private messages from, and to talk to their friends at a distance. Some patients get their friends to read to them in this way, the reader sitting at home in his library and the patient listening through his telephone.

⁂ The Empire State Telephone & Telegraph Co. have lately put in a new and enlarged switchboard in their central office at Cortland, N. Y., to meet the demands of their growth in that direction. President H. L. Storke is a thoroughly wide-awake telephone man and gives his subscribers excellent service. The switchboard is furnished by the Eastern Electrical M'f'g Co., of Tonawanda, N. Y., and was put in by Messrs. Gould and Smith (the inventors) representing that company.

⁂ The Supreme Court has sustained the broad fifth claim of the Bell Company, which is the basic claim in the patent, and which seems to make it impossible now for any person to secure a new valid patent for a speaking telephone. The fifth claim is for the transmission of audible speech by electricity. Unless this decision is greatly misunderstood by the lawyers, it goes so far as to declare that the Bell Company has an absolute monopoly over the principle of transmitting audible speech by electric wire.

⁂ Philadelphians are largely indebted to the long-distance telephone of the American Telephone and Telegraph Company for news obtained during the last two days from New York and Europe. At a time when the telegraph lines were all broken down or unserviceable, the telephone lines between New York and Philadelphia were available, and were of the greatest use to merchants and others by day and newspapers by night. The telephone wires outside of the city are overhead, just the same as the telegraph wires are, and to those who do not know about the care taken in their construction it may seem strange that they should withstand a storm that wrecked parallel lines belonging to the telegraph companies. The reason is found in superior construction of the telephone line, which is new, and to the liberal expenditure of money to make it as nearly perfect as the superior resources of to-day permit. It is to the credit of the company and its managers, who erected substantial lines, capable of large extension, beginning their enterprise on a basis which shows that they have full faith in the growth of their business on its merits.—*Philadelphia Ledger.*



It is reported that the Thomson-Houston Company has purchased the Daft electric motor.

The Electric Street Railway Company of Chattanooga, has been granted a franchise by the council of that city.

Eight more cars have been ordered for the electric road in St. Joe, Mo. The road is succeeding finely, the Sprague motor being used.

May 1st the Sprague Motor Company moves into much more convenient and extensive offices in their present building, 16 and 18 Broad street.

Two patents were granted Mr. Stephen D. Field, last week, on electric locomotives. One of these was applied for in 1886, the other December, 1887, and they relate to his motor which was recently exhibited on the New York elevated road.

The Electric street railway people of Lincoln, Nebraska, will have something to say in a day or two. They are determined to inaugurate a boom in the southeastern part of the city, and they are said to be men who will not fail in any undertaking.

Work is now progressing vigorously on the electric railway at Sacramento, Cal., and the promoters of the scheme declare that the road is to be pushed to completion. The grading from R to Y streets is almost finished, and sixteen men are engaged in laying ties and rails. More help and teams are advertised for.

The town of Pullman, Ill., is to have an electric motor system. It will be a double track belt line, and will go around the town. The belt will be about five miles long. It is the intention to commence work immediately, and Mr. Charles L. Pullman has been studying the different electric railway systems, but thus far has not decided which one he will adopt.

The large electric motor to be used at Ansonia, Conn., on the electric road in drawing freight cars has arrived at the station there. It weighs several tons and is enclosed in a neat looking car about eighteen feet in length. Cars can be coupled on at either end and it is arranged to run forwards or backwards. One peculiarity is that the car in which it is enclosed sets down within six inches of the track. It was made at the works of the Pullman Car Company at Pullman, Ill.

Building operations on the Electric Railway between Rochester, N. Y., and Charlotte, will be commenced as soon as the frost is out of the ground, and it is expected the road will be finished next fall. Cars will be drawn to the Holy Sepulchre Cemetery by horses until the new line is in operation—the tracks between that point and the Ridge road to be laid by June next. The officers of the company are Asa T. Soule, president; Levi Hey, treasurer; J. Breck Perkins, secretary, and Stephen Stace, superintendent.

It is suggested by the New York Electrical Review, in the matter of the use of storage batteries for street car purposes, that an independent motor or battery can be provided. Instead of removing the batteries, they can be charged in the car, which can be side-tracked at the proper point for that purpose, a freshly-charged motor car taking its place. This would save handling the battery jars, but would require a large number of idle motor cars. By the way, the use of independent electric motors is by no means new, as such an one was used by Messrs. Woodhouse and Rawson in connection with the electric railway at the Newcastle Exhibition.—*London Invention.*

An electric elevator invented by Mr. Charles Whittier, has been introduced in Boston with commercial efficiency under conditions where its electrical efficiency is unrestricted by the enforced conditions of its installation. The elevator mechanism is of the closed tank type, the car being raised by the power furnished from the closed tank of oil under pressure, and with a cushion of compressed air in the upper portion of the tank. When the pressure in the tank is lowered, the lever of the diaphragm regulator, the same as is used in connection with boiler dampers, admits oil under pressure to the upper side of a piston through a constricted orifice, moving the power switch over and admitting the current gradually to the dynamo. When the pressure in the tank reaches the standard, the rising of the lever of the regulator opens the valve, which discharges the oil very rapidly from the piston under the switch of the electro-motor. The elevator car can be operated in the usual manner with a rope or handwheel, or by a couple of electrical knobs each engaged with solenoids which operate valves to raise or lower the elevator car. In the upper portion of cities where the public water-pressure is low, and other places within ready reach of the wires from an electric lighting station.

General Electric Clublets.

Twenty-six new members were elected last week.

The Boston Electric Club is noted for the hospitality of its members.

The sleeping apartments at the Club are so well patronized by non-resident members that they have all been occupied for two weeks past.

The election of officers for the ensuing year of the Electric Club occurs Thursday of this week. The result will be announced in our next issue.

Mr. E. T. Gilliland's address on the phonograph is announced for Saturday evening, April 28th, and will be delivered only to the members of the Club and Messrs. Edison and Gilliland's invited friends.

Mr. Morris W. Mead. Supt. of the Bureau of Electricity, Pittsburgh, returned to his duties Friday, having accomplished the object of his mission to the East. His many friends in the Electric Club hope to see him here again in May.

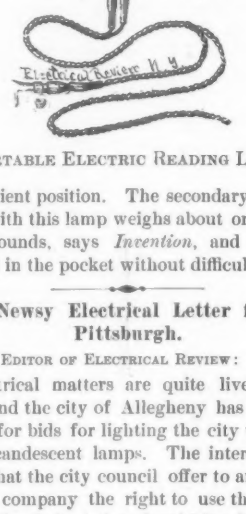
There was quite a gathering of electrical men that dropped in informally at the Electric Club one evening last week. The list comprised a number of well-known names, including Prof. Anthony Reckenzaun, of England; John I. Sabin, of San Francisco; M. M. M. Slattery, of Fort Wayne; Eugene F. Phillips, of Providence; George F. Porter, of Philadelphia; H. D. Stanley, of Bridgeport; Morris W. Mead, of Pittsburgh; Stephen D. Field, J. N. Keller, M. W. Goodyear, H. C. Davis, Lieut. F. W. Toppan, Hon. Henry D. Lyman, Willard L. Candee, Henry Hine, Cyrus O. Barker, Jr., and numerous other New Yorkers. These pleasant informal gatherings at the Club prove an agreeable means of acquainting electrical men.

Electrical Science Solved the Puzzle.

A Meriden, Conn., clothing-dealer recently offered a spring overcoat to any person solving the "anti-rattle-box" puzzle. This consisted of a short cylindrical wooden box securely sealed. The point was to shake the box without rattling the contents. On the box was printed: "You can't do it; but it can be done." Those who got hold of the boxes, after shaking them in different ways, cut them open and found the contents to consist of pieces of tin of different shapes. As no method of doing the trick could be thought of, it was generally supposed that the puzzle could not be solved. Charles M. Fairchild, assistant to Superintendent Fitzgerald of the Meriden Electric Light Company, came into possession of one of the boxes. He dissected it, noticed the bits of tin, thought a moment, and then, taking a piece of magnetized iron, replaced the cover of the box and applied the magnet to one end. It was strong enough to attract all the small pieces of tin and hold them fast to the end of the box however violently it was shaken. He got the overcoat.

An Electric Reading Lamp.

We illustrate a new form of portable electric lamp, recently brought out by English manufacturers. It is attached to a flexible cord, so as to enable it to be placed in any



Portable Electric Reading Lamp.

convenient position. The secondary battery used with this lamp weighs about one and a half pounds, says *Invention*, and can be carried in the pocket without difficulty.

A Newsy Electrical Letter from Pittsburgh.

To the Editor of Electrical Review:

Electrical matters are quite lively here now, and the city of Allegheny has decided to ask for bids for lighting the city with arc and incandescent lamps. The interest is so great that the city council offer to any competing company the right to use the public square for their station, furnishing free land, free water, and free fuel (natural gas). Already the Ball Company has set up their plant, and two others are arranging to do so. The Allegheny County Light Company will compete for the work, but they now have a complete station in operation, and cannot take advantage of the liberal offer of the city. From the way the applications are coming in a lively time is expected. Companies wishing to compete should address R. T. White, city clerk, Allegheny, Pa.

The Allegheny County Light Company are now operating 15,000 incandescent lamps and 300 arc lamps. They operate three stations, one of which it is proposed to abandon and remove the machinery to the station (A) in Virgin Alley, and all the lamps now operated from the station to be abandoned will be operated from station A. They have lately put in a 500 horse additional boiler power, and one of the new Westinghouse compound engines.

The Westinghouse Electric Company have just made a stock dividend of 2½ additional new shares for one old share. Their works are crowded with orders, and 1,000 persons are now employed at their works.

The East End Light Company are in their new station, and distributing current over a six mile circuit. The station is a model for neatness and efficiency.

The Observatory Hill Electric Road in Allegheny, and the Knoxville Electric Road in Pittsburgh, are both working nicely.

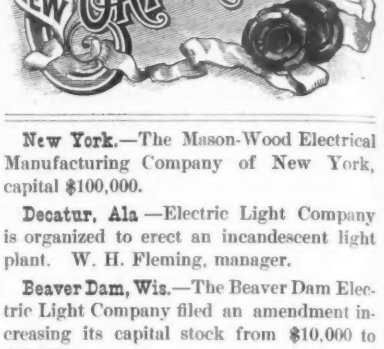
The Western Union Telegraph Company are placing a large amount of underground cable in Pittsburgh, on Wood street.

The Central Dist. and Printing Telegraph Company (Bell Telephone), are arranging to move into their new and handsome exchange in Allegheny.

The Pittsburgh and Allegheny Passenger Railway Company have under consideration the equipment of their road as an electric railway, and will commence work at an early day. A. B. C.

Pittsburgh, April 13, 1888.

* * To Moissan belongs the honor of having isolated beyond a doubt the element fluorine, which so many chemists have endeavored to lure from its accompanying substances. As was expected, it is a gas. Even silicium and boron burn in it with brilliant combustions. Water is decomposed by it, cork is inflamed, as are also alcohol, turpentine and petroleum. The chemical energy of this element surpasses that of any other known element. If it can be produced on a practical scale it may become a powerful factor in technical chemistry.



New York.—The Mason-Wood Electrical Manufacturing Company of New York, capital $100,000.

Decatur, Ala.—Electric Light Company is organized to erect an incandescent light plant. W. H. Fleming, manager.

Beaver Dam, Wis.—The Beaver Dam Electric Light Company filed an amendment increasing its capital stock from $10,000 to $25,000.

Joliet, Ill.—The Joliet Electric Light Company has been incorporated. Capital, $50,000. Lewis E. Ingalls and others, incorporators.

Georgetown, D. C.—The Potomac Electric Light and Power Company has been incorporated. J. W. Thompson and others, incorporators.

New York.—The Central Auxiliary Fire Alarm Company, New York, N. Y. Capital, $500,000. Wm. H. Whiton and others, incorporators.

Gravesend, N. Y.—The Atlantic Electric Light Company has been incorporated. Capital, $25,000. James J. Powers and others, incorporators.

Nashville, Tenn.—H. B. Buckner, A. Dahlgreen, Samuel Cowan, J. H. Bruce and others have incorporated the Edison Company, of Nashville, Tenn.

New York.—The Knickerbocker Telephone Company has been incorporated. Capital stock, $125,000. Henry E. Townsend, Gustave Frank and Charles L. Camman, trustees.

Ansonia, Conn.—The directors of the electric street railroad of Ansonia, Conn., elected officers, as follows: President, H. Holton Wood; vice-president, Wm. Powe; treasurer, C. E. Clark; secretary, W. J. Clark.

Nashville, Tenn.—H. B. Buckner, Edgar Jones, A. Dahlgren, Samuel Cowen, B. Lanier, J. H. Yarbrough, J. H. Bruce, R. H. Dudley, James M. Head, T. M. Steger and A. W. Wills filed a charter for the Edison Company with the county register at Nashville, last week.

Boston, Mass.—The Electric Exchange has been formed with the following board of officers: President, P. H. Alexander; secretary-treasurer, H. B. Cram; directors, the president and secretary-treasurer and Messrs. Robert Amory, Frank Ridlon and George W. Davenport.

Niagara Falls, New York.—The Niagara Falls Hydraulic Power Company, with a capital of $100,000, has been incorporated to operate hydraulic works at Niagara Falls. The incorporators are Daniel G. Thompson, Edward Kaufman, George H. Benjamin and David W. Brown.

Manufacturing Notes.

The demand for the Ball engine has been so great that the company has been forced to increase its capacity and add special tools of the most approved pattern.

The Edson Pressure Recording Gauge seems especially popular with the various Edison Electrical enterprises, the Edison Machine Works of Schenectady having just ordered their second instrument.

The old works of the Forest City Carbon Co., we understand, have been purchased by and are to be completely refitted and operated under the auspices of the Ohio Valley Carbon Co. The carbon business must be flourishing.

The New York Belting & Packing Company, of New York, have supplied the largest rubber belts ever manufactured in the United States, and their goods, which have a national reputation for excellence, are coming into considerable prominence abroad. At the warehouse of the company, 15 Park Row, N. Y., may be seen immense rubber elevator belts weighing eight tons, in transit via Hamburgh to Budapest, Hungary.

OUR SOUTHWESTERN LETTER.

(Special Correspondence.)

'Tis some time since I wrote you last, and I want to compliment you first of all upon the improved appearance of the REVIEW, cover and all. I get and read several other electrical journals, but the REVIEW seems to fill a place none of the others can, be they ever so good.

Gas *versus* Electric Light has been attracting considerable attention here lately. The city has been at outs with the gas company in reference to a contract between them for twenty years, at $48 per street lamp. The city wanted a larger deduction than the gas company wanted to allow, so, as there was a clause allowing the city to adopt electricity, they have been advertising for some time for bids, to either furnish the lights or a plant. And they have or are about to close a contract for a $27,000 plant of the Ft. Wayne Jenney Electric Light Co., which they intend to run and furnish their own lights. They figure they can save the price of the plant in four years. The Westinghouse people have had a representative here trying to organize an incandescent company. I understand they have filed articles of association with $50,000 capital, but the matter seems to be moving very slowly.

The Supreme Court decision made mighty interesting reading for numbers of people in Arkansaw. This is a regular hot bed for telephone infringers, and the decision was a decided black eye to them. The suit of the Bell Company against the Southern Telephone Company, who are running the largest exchange ever operated in opposition to the Bell Company, comes off here April 16th, and Sunday and Monday next will see a big array of telephone and legal talent. Judges Brewer and Caldwell will hear the case. Messrs. Storrow and Dickerson with Judge McClure and E. W. Kimball, local attorneys, will appear for the Bell Company, while Hon. Casey Young and Jeff Chandler of Washington, D.C., assisted by Rose & Rose, of Little Rock, will represent the Southern Company They claim to have evidence of an entirely new character to introduce and that the case is to be the toughest one the Bell Company has yet tackled. They have a new non-infringing "intermittent telephone," invented by their own electrician especially for the occasion and mean to down "the greatest monopoly the world has ever seen" or "bust." I will write you an account of the "bust" next week. A. F. A.

Little Rock, Ark., April 9th.

Electricity and Tornadoes.

H. Allen Hazen writes to the *Globe-Democrat*, St. Louis, as follows concerning the electrical theory in the matter of disastrous storms and tornadoes:

"It has been generally accepted that in all atmospheric disturbances the presence of electricity is an effect and never a cause. All attempts to explain the presence of such large quantities of electricity have entirely failed. It is dangerous for any one to ascribe any unexplained phenomenon to electricity, but there seems to be no reason why it may not be concerned in the formation of the funnel cloud. Dry air is almost a perfect non-conductor; if there be a supersaturated cloud it may be charged with electricity to an enormous potential. In 1857 Prof. Blodget wrote on tornadoes (see Climatology, p. 402): 'The greatest difficulty exists in explaining the facts in regard to their narrow limits while the fullest measure of violence is retained, and this can only be done on the supposition that electrical energy makes up a very large share of the force.' We are just beginning to learn the possibilities in electric energy, and one can not well assert that it does not have much to do with tornado formation. I have space for a single illustration: The apparent explosion of a house, e. g., the house of Adolphus Isom at Mount Vernon is brought forward as a proof of the vacuum theory. In August, 1885, an analogous phenomenon came to my attention which was clearly due to electric action. A house having a tin roof and without lightning rods was struck by lightning. The electricity passing between the weather boarding and the plastering, plowed a furrow in the ground at the base of the house and disappeared in a pool of water near by. The weather-boarding was violently burst off on the outside, while the plastering and clothes in the closet were thrown nearly across the room on the inside. There seems to be no reason why we may not explain other similar phenomena in this way. While some form of electric energy seems an important factor in tornado action, yet this should serve to allay our fears of danger. If Franklin, by the simple device of the lightning rod, secured immunity from lightning strokes, is it too much to expect that the genius of these later times will not discover some method of warding off or ameliorating the evils in this case. It may be that the time is not far distant when, owing to the gravity of the problem, we shall see experiments carried on at great cost looking to the dispersion of the funnel cloud by discharges of ordnance or explosives. It is of the utmost importance that we gain correct views of the manifestations, and in this many can help. It is customary to examine only the immediate havoc produced, but in order to study the question minutely we should have observations at points just before and after that of the greatest devastation. If it is admitted that tornadoes are analogous to thunder-storms, we have a most inviting field for research and one that is often present on warm summer days and frequently in many States."

Distributed by Battery Transformers.

Mr. R. E. Crompton, in our contemporary *Industries*, puts himself in print with a series of figures attempting to prove distribution by battery transformers to be as cheap as and better than that by alternating current transformers, but unless we are greatly mistaken, he will find plenty of opponents to take up the gauntlet. Indeed, Mr. Manville's letter to our London contemporary, the *Electrical Review*, has already taken the props from under him by the closing sentence of his letter:

"One is bound to conclude, therefore, that 'the bottom has been knocked out' of many of the arguments used in the course of the discussions above referred to, and that the consensus of opinion in this country in favor of distribution by means of transformers is fully justified and strengthened by what is being achieved daily in America."

Mr. Crompton's comparison is as follows:

COST OF GENERATING AND DISTRIBUTING PLANT FOR 10,000 60-WATT GLOW LAMPS, BURNING SIMULTANEOUSLY.

With Secondary Batteries.

Motive power, six 166 i.-h.-p. setts = 996 i.-h.-p., at £8. 12s.	£8,700	0	0
Dynamos.	4,800	0	0
Building to suit above	8,000	0	0
Charging main, 45 tons at £80	3,650	0	0
Laying ditto in culvert	1,500	0	0
Distributing mains, 12,000 yards at 16s. per yard	9,600	0	0
Service boxes, 450 at £2	900	0	0
Batteries, four sets of 50 cells each	8,640	0	0
Regulating gear	1,000	0	0
	£48,790	0	0

With Alternate Current Transformers.

1,450 i.-h.-p., at £8. 12s. per i.-h.-p.	£12,500	0	0
Dynamos and exciters	5,540	0	0
Building to suit above.	11,000	0	0
Charging main	2,400	0	0
Distributing main, 12,000 yards at 14s. per yard	8,400	0	0
Service boxes, 450 at £2	900	0	0
Regulating gear	500	0	0
Transformers, assuming one large one for two houses, 300 at £25 (including fixing)	7,500	0	0
	£48,740	0	0

The Ball Electric Company.

The newly elected board of directors of the Ball Electric Company, 18 Cortlandt street, is composed of F. C. Newhall, Frederick Lovejoy, Robt. Dunlap, John C. Noyes, Wm. L. Brown, James H. Breslin, Geo. W. Cottrill, Sol. Sayles, W. S. Hopkins, De Witt C. Wheeler and Chas. E. Ball. Mr. F. C. Newhall who has been acting president for a few months past will remain, and is bringing the company into more prominence and securing more business than ever came to it in the past. The company has recently brought out a four-ampere dynamo, from which 3½ arc lights of 800 candle power are guaranteed per horse power.

In addition to a number of isolated plants that this company has quietly secured, new stations have been put in, or are under contract in the cities of Cincinnati and Wellston, Ohio, Muncie, Ind., Clarksburgh, W. Va. A new plant is also being put in at Napa City, Cal.

Nothing Like a Good Start

"Hallo, conductor! What are all those derricks and hoisting tackles at this station for?"

"Oh, this is the home of an eminent Chicago electrician. He has invented a flying machine, and they are trying to hoist it up for a trial trip to-day.

Electric Light Towers in the West.

Council Bluffs is probably one of the most brilliantly lighted cities in the whole Missouri valley. The city is supplied with six electric light towers, with four mammoth lamps each, located in different parts of the most densely populated portion of the city. These towers were erected a few months ago, and at first were a sort of experiment, the people thought. They have proven so satisfactory that those parts not yet supplied are clamoring for a tower in their particular locality. It is understood that the city council will soon order three or four more.

Cars Lighted by Electricity.

Preparations which have been under way in Albert Lea, Minn., for some time, were completed last week, and the afternoon train for Burlington, on the Burlington, Cedar Rapids and Northern, left with storage batteries charged with electricity, and all the cars fitted with Edison incandescent lamps to light the cars on the run that night. A test was made before the train started, and everything worked perfectly. There are eight lamps in each car and one at one end on the outside. The storage battery is supplied to run thirty lights ten hours. By invitation several citizens were present and witnessed the first electric lighting of a railroad train west of Chicago. The trial was an evident success. It is likely the Minneapolis and St. Louis will also soon light their trains by electricity.

Texas a Great Electrical State.

In a recent interview, Mr. Wm. Lee Church is reported as follows:

"Texas is advancing in the use of electric light very rapidly. We have more central stations there than in any other State of the Union. We have only lately established stations at Houston and Marshall. The chief reason for this appears to be that the cost of coal there is considerable, which makes artificial gas accordingly expensive."

"By the way," said Mr. Church, as the reporter was going to leave, "as an item of news I may as well tell you that we have now effected the manufacture of an arc lamp, which can be operated from the same circuit as the incandescent lamps. This is of importance, because it will give all local companies an opportunity to cover all electric lighting with one apparatus."

—— An electric lighting company has been organized at Great Falls, N. H., with a capital stock of $15,000. H. W. Burgett of Boston, has been awarded the contract for lighting the town for the term of ten years.

—— The Thomson-Houston electric light plant in the Union depot, Chicago, which consists of 60 arc lights and 800 incandescents, was successfully started the last of January, and has been in continuous and satisfactory operation ever since. This is the third of the five principal depots of Chicago which is lighted by electric lights. The Dearborn station has the Western electric system, the Lake Shore has the Ft. Wayne Jenney.

—— April 1st, the Salem, Ohio, Electric Light and Power Company turned on their 330 street lights of 25 candle power each, and everything worked to the satisfaction of the public and the company. In two months this company put up the building, 550 poles and twenty-seven miles of wire. The largest main is No. 1. The system is the Westinghouse, and the demand would seem to indicate that the present plant will soon have to be greatly enlarged. The Messrs. M. Davis, D. L. Davis and D. W. Davis compose the company, and a wide-awake family they evidently are, judging from the expeditious manner in which they did the work.

ELECTRIC LIGHT NEWS

—— Richmond, Ind., is desirous of having the electric light.

—— Jacksonville, Fla., is about to double the capacity of their electric plant.

—— The city of Buffalo uses 641 electric lamps for city lighting, and is a well-lighted city.

—— The Electrical Accumulator Company, Detroit, has over 2,000 lights contracted for.

—— At Montgomery, Ala., the Adams Cotton Mills are about to add an electric light plant to their mills.

—— The capital stock of the Kingston, Ontario, Electric Light Company has been increased from $3,000 to $50,000,

—— The electric light company of Olean, N. Y., is preparing to erect its poles and lines, and will be in operation shortly.

—— At Key West Fla., the Gas Co. has made an arrangement to add a Brush electric light plant to better light the town.

—— The electric light company of Winsted, Conn., are putting in a new dynamo to supply increasing demands for light.

—— The citizens of Frederick, Md., are decidedly in favor of the electric light, and several companies are bidding on the plant.

—— The contract for lighting Lancaster, Pa, has been awarded to the United States Electric Lighting Company for three years.

—— New Zealand is taking quite an interest in electric lighting. The towns of Wellington and Christchurch are asking for bids.

—— At Troy, N. Y., 262 arc lights are used by the city. The contract for another year has been awarded to the Troy Electric Light Company.

—— Catlettsburg, Ky., contemplate putting up an electric plant and invite proposals from manufacturers. The town has a population of 3,000 inhabitants.

—— The proprietor of the Harrisville machine shop, Mr. J. W. Avery, is said to be the first to introduce electric light into Phenix, Rhode Island, having built, for use at his shop, an incandescent light of satisfactory operation.

—— The Brush Electric Light Company's building, Minneapolis, was thrown open for public inspection the evening of April 4th, and some 30 or 40 persons, including a number of ladies, explored the mysteries of the works to their heart's content.

—— Mr. Hiram Purdy, of Burlington, Iowa, has invented a lamp reflector. It is now undergoing a test, which seems to be perfectly satisfactory in its results, and Mr. Purdy hopes that it will be adopted generally. He may make arrangements for its manufacture.

—— The Common Council at Wabash, Ind., has entered into a contract with the Wabash Electric Light Company to light the streets for a period of five years. One hundred and twenty-seven 30-candle power lights will be distributed over the city, the rental therefor being $2,300 per annum. The incandescent light will be used, and the company will have it in operation by May 1.

—— After several months of delay the town of San Rafael, Cal., was lighted by electricity last week for the first time. Twenty-one masts have been erected, each 60 feet in height, and arms extend from the tops of them, from which the lamps are suspended. The plant was constructed at a cost of about $30,000, and the town authorities have granted a franchise for lighting the streets by electricity for a term of five years.

ELECTRICAL PATENTS

(Copies of any Patents in the following List will be sent to any address on receipt of twenty-five cents.)

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING APRIL 10, 1888.

380,702 Dynamo; Henry B. Slater, Detroit, Mich., assignor to the Detroit Motor Company, same place.

380,732 Telephone transmitter; Isaiah H. Farnham, Malden, assignor to the New England Telephone and Telegraph Company, Boston, Mass.

380,757 System of electrical distribution; William H. Hart, Brooklyn, and James T. Goodfellow, Troy, N. Y., assignors to William Hampden Johnstone, Philadelphia, Pa.

380,765 Electric accumulator; John M. Pendleton, New Brighton, N. Y.

380,766 Electric cut out; Charles G. Perkins and J. Tregoning, Hartford, Conn.

380,778 Municipal telegraph apparatus. 380,779 Municipal telegraph. 380,780 Telephone and signalling circuit; John C. Wilson, Boston, Mass., assignor to the Municipal Signal Company, Portsmouth, N. H.

380,817 Electrical governor; Frank E. Prichard, Cedar Falls, Iowa.

380,824 Electrical speed indicator; Frederick W. Schlepegrell, Charleston, S. C.

380,829 Electrical hand cord tip; Henry J. Swarts, Detroit, Mich., assignor of one-half to J. W. Dart, same place.

380,842 Apparatus for examining ores; John R. Williamson, Seattle, W. T., and William W. Hickies, Oakland, Cal.

380,845 380,846 System of electric translation; Reginald Belfield, Pittsburgh, Pa., assignor to the Westinghouse Electric Company, same place.

380,855 380,856 Galvanic battery; Horatio J. Brewer, New York, N. Y.

380,879 380,880 Electric locomotive: Stephen D. Field, Yonkers, N. Y.

380,905 Electrical telephone; F. du Pont Marston, Philadelphia, Pa.

380,922 Electrode for secondary batteries; Richard Packer, Chester, Pa.

380,925 Microphone transmitter; George M. Phelps, Brooklyn, assignor to the Western Union Telegraph Company, New York, N. Y.

380,942 Electric indicator.

380,943 Volt-ammeter.

380,944 Electrical pressure indicator.

380,945 Adjustable inductive resistance; Oliver B. Shallenberger, Rochester, assignor to the Westinghouse Electric Co., Pittsburgh, Pa.

380,946 Central station for alternate current systems of electrical distribution; Oliver B. Shallenberger, Rochester, and Henry M. Byllesby, Pittsburgh, assignors to the Westinghouse Electric Company, Pittsburgh, Pa.

380,947 Electrical indicator; Oliver B. Shallenberger, Rochester, assignor to the Westinghouse Electric Company, Pittsburgh, Pa.

380,971 Construction of stationary and itinerant electrical batteries; James T. Armstrong, London, England.

380,989 Secondary battery; Hiram H. Carpenter, New York, N. Y.

381,004 Apparatus for forming sheets of nickel or other metal by electrolysis; Moses G. Farmer, Eliot, Me.

381,054 Alternate current system of electrical distribution; Henry M. Byllesby, Pittsburgh, and Oliver B. Shallenberger, Rochester, assignors to the Westinghouse Electric Co., Pittsburgh, Pa.

381,086 Railroad signal; Wardell B. Sherman, Oneida, N. Y.; Marian E. Foland and Charles G. Foland, administrators of said Sherman, deceased.

William Marshall,
Manufacturer of Electrical Condensers.
STANDARDS A SPECIALTY.
Rooms 2 and 4 University Building.
Corner Waverley and University Places, New York.

SAFES,
Fire and Burglar Proof Safes
For all Purposes.
Bank and Safe Deposit Vaults, Vault Doors, &c.
Estimates and drawings furnished.
DIEBOLD SAFE AND LOCK CO.,
W. H. BUTLER, Gen'l Agent, 79 Duane St., N. Y.

Any person having valuable patents or ideas in Electricity, and not having sufficient funds to demonstrate them, may obtain money and business experience and use of powerful dynamo by writing to Box 356, New York.

State date of patent and full particulars.

BALL AUTOMATIC CUT OFF ENGINE
MADE ONLY BY
THE BALL ENGINE CO
ERIE PA.

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Electrical Review Patent Bureau

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S. H. SHEARER,
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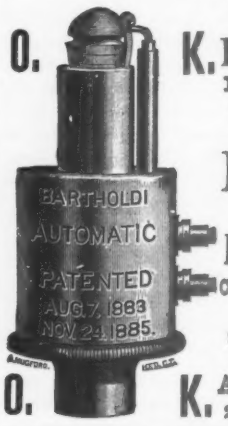

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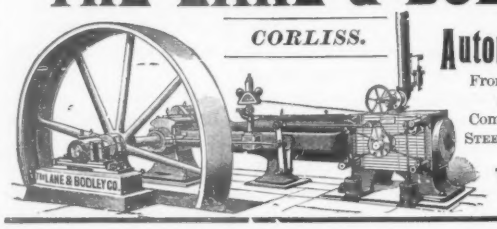

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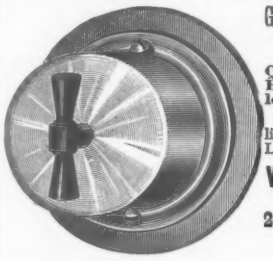

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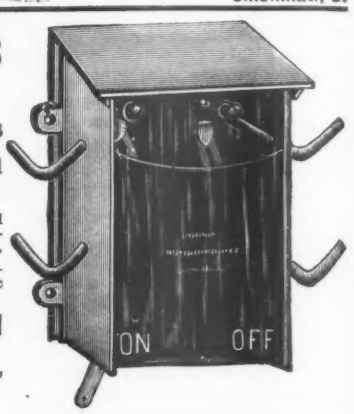

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